THE HEATING AND VENTILATING MAGAZINE

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Air Conditioning for Factory Offices

Heating and Ventilating Equipment for Plant of the B. J. Johnson Co., Milwaukee, Wis.

Each time the sand runs through the hour glass at the plant of the B. J. Johnson Soap Co., Milwaukee, Wis., 14,400 cakes of Palmolive soap are produced—four cakes a second, 240 cakes a minute, 14,400 cakes an hour for every working day. This remarkable output is due, in no small measure, to the elaborate arrangements for conditioning the air on the three upper floors of the solid concrete structure that serves both as the company's factory and general offices. The three floors supplied by the system are occupied by the gneral offices. There is also a branch duct leading to the lunch room on the fifth floor.

The balance of the factory is heated with exhaust steam and direct radiation.

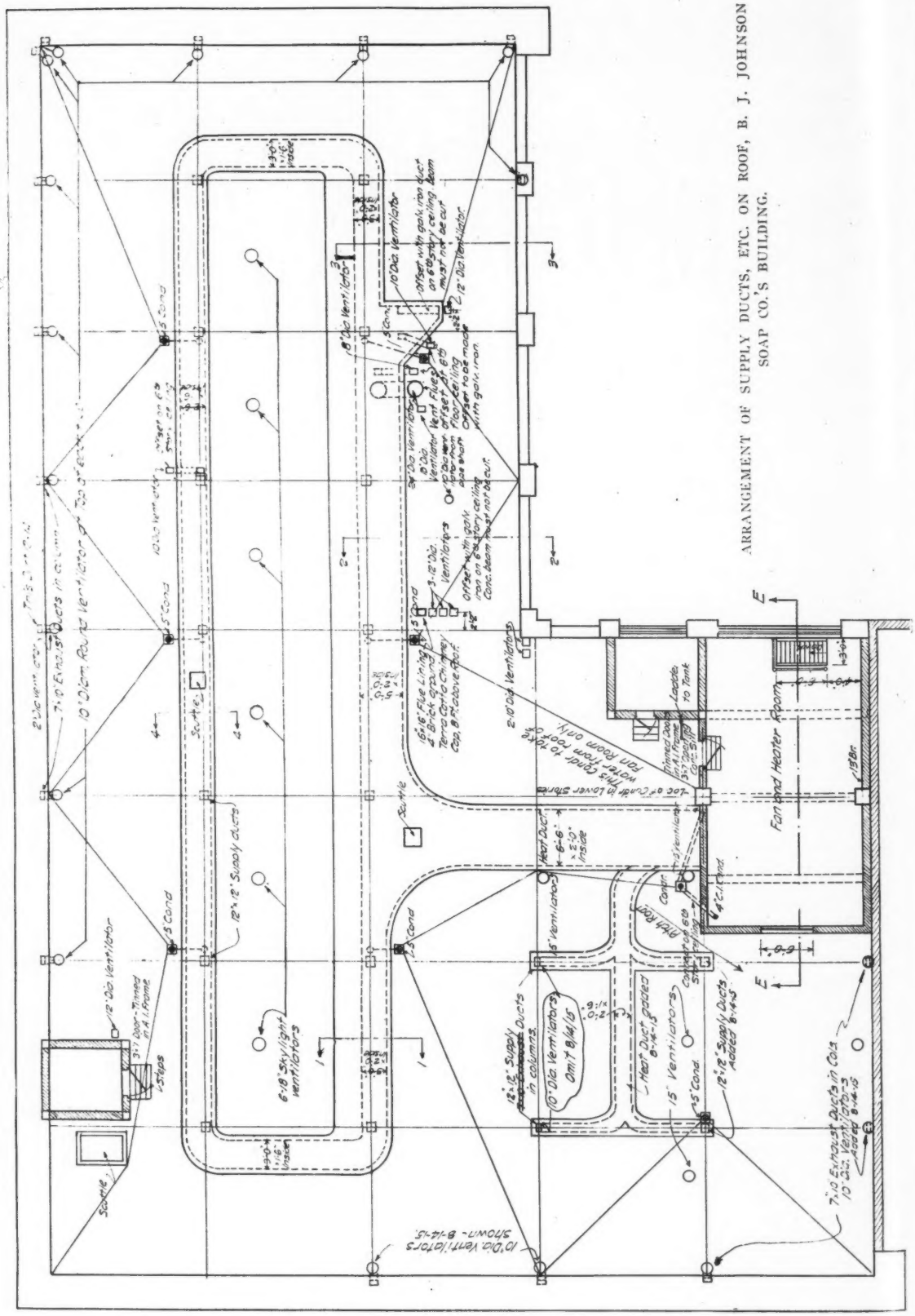
Every effort has been made to reduce to a minimum waste spaces throughout the building and to this end the hollow supporting columns have been utilized as fresh air ducts. The designers have even gone a step further in having the distributing ducts run along the roof to the hollow concrete columns. This required careful insulation of the roof ducts, as shown in the accompanying illustrations.

With this arrangement of air supply no floor space is used for radiators on the three upper floors.

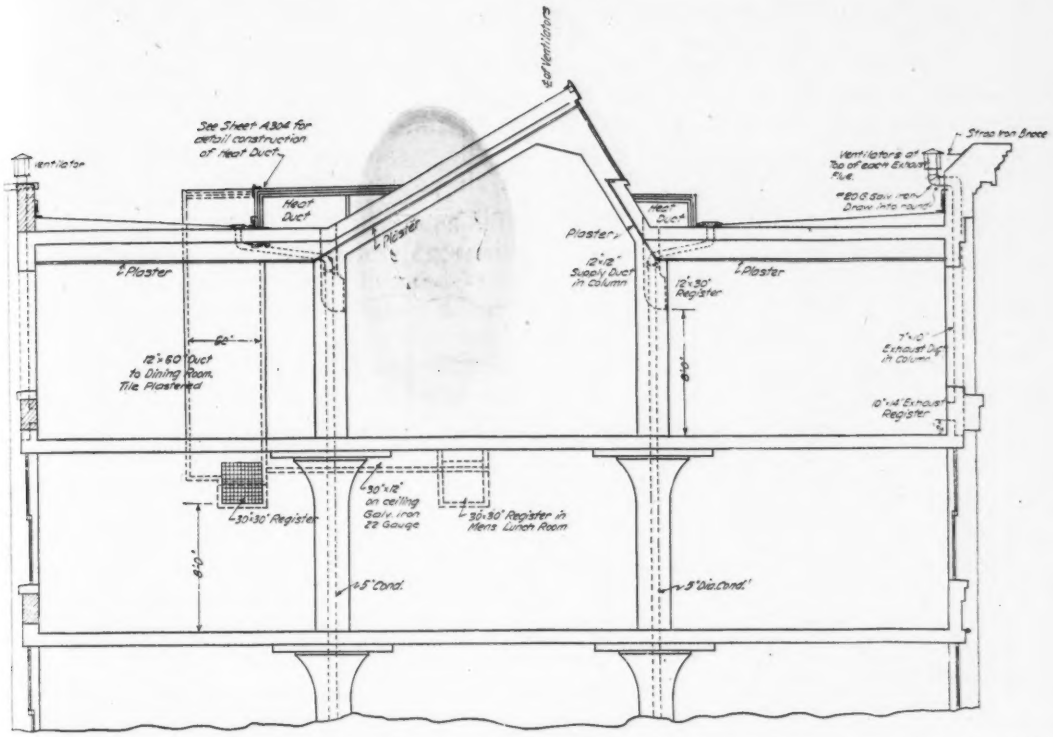
Another departure from the usual is to be noted in the exhaust system. The used air is carried by its natural tendency to rise through ducts with openings near the floor line. This system is supplemented in the summer time by dampers, set in the skylight on the top floor. These dampers must be kept closed in winter when the fan is pumping hot air, as otherwise they would interfere with the circulation. In the summer, when the air from the fan is cooled by the air washer (the heating coils being turned off) the used air is the warmer and tends to rise and bank in the skylight. In warm weather, therefore, the double exhaust through both ducts and dampers add considerably to the flexibility and efficiency of the system.

The fan and air washer equipment is located on the roof of the building. It includes a Sirocco engine-driven fan having a capacity of 19,000 cu. ft. of air per minute. The heater is made up of a tempering coil containing 570 sq. ft. of Vento radiation and a reheating coil containing 1,140 sq. ft. of Vento radiation. The fan is driven by a vertical center-crank 6 in. x 5 in. engine. The water for the air washer is circulated by a small motor.

There have been one or two changes made since the original installation was completed. It was found that some form of local adjustment was necessary on the outlets, as some employees preferred



ARRANGEMENT OF SUPPLY DUCTS, ETC. ON ROOF, B. J. JOHNSON SOAP CO.'S BUILDING.

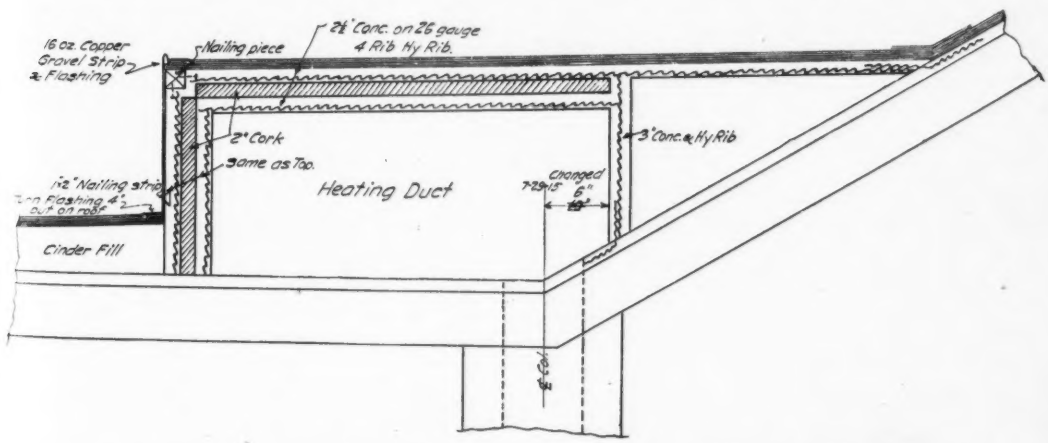


SECTION OF B. J. JOHNSON SOAP CO.'S BUILDING, SHOWING AIR DISTRIBUTION THROUGH BUILDING COLUMNS.

more or less air than others, and while the original installation provided polished brass register faces only, there have since been installed individual shutters of a deflecting pattern on each outlet. These shutters, when open, deflect the air to a more nearly horizontal travel, and may be closed tightly, in a similar manner to ordinary register dampers. They are operated by chains from the floor.

In the construction of the hollow ducts in the columns no particular difficulties were met with, and sheet metal forms were constructed in advance and anchored into place in the wood forms previous to the pouring of concrete. Before pouring concrete these metal forms were filled with dry sand which was allowed to run out after the concrete was set.

The construction of the roof duct did not offer any particular difficulties, and was carried out exactly in the manner indicated by the drawings.

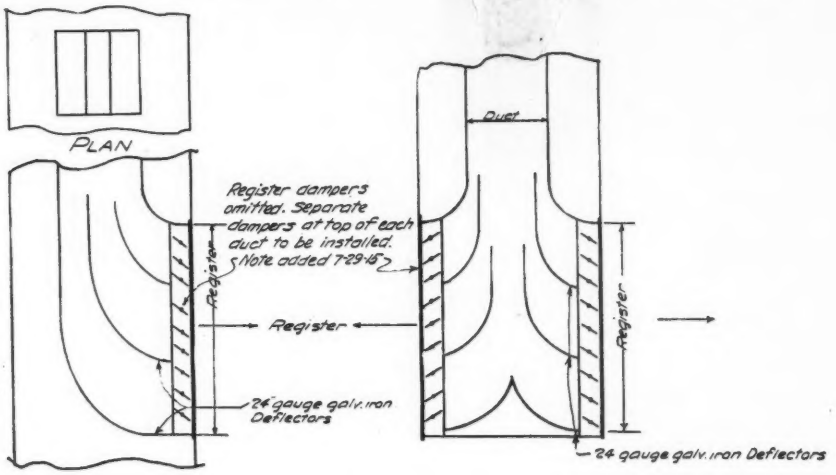


INSULATION FOR HEAT DUCT ON ROOF, B. J. JOHNSON SOAP COMPANY BUILDING.

As originally installed there was a deflecting damper in the horizontal duct at the top of each vertical shaft. It was expected to be able to set these permanently in positions which would insure an equal supply of air to each, but due to the causes above mentioned it was later found more desirable to have individual control which could be varied from day to day on each outlet.

The operation of the system is very satisfactory and provides the best of air at all times in the office.

The arrangements for taking air out of the room will doubtless be clear on inspection of the drawings.



DEFLECTORS IN SINGLE DISCHARGE REGISTERS PROVIDED FOR ALL SUPPLY DUCTS.

The exterior columns of the building contain exhaust ducts with openings near the floor, the idea, as stated, being to open dampers into these during the Winter so that the cooler air will be taken from the roof. In the Summer these dampers will be shut and air will be allowed to escape through the ventilators along the top of the skylight, this taking the warmest air out of the room.

Arrangements have been made for circulating cold water from an artesian well in the air washer for slight cooling effect in Summer, and it has further been contemplated to install a brine coil in the air washer tank, as this plant is already equipped with refrigeration and it would simply mean the extension of brine piping for a short distance. This could be used in extremely hot summer weather such as we experienced last summer.

The heating and ventilating equipment was designed by S. B. Lincoln, engineer for the Chicago office of Lockwood, Greene & Co., architects and engineers.

Coke in a Residence Heater Designed For Coal

By DONALD B. PRENTICE, M.E.
Instructor in Mechanical Engineering, Yale University.

The high price of anthracite coal has led many householders in the Eastern cities to seriously consider the feasibility of substituting some other less expensive fuel for warming their homes. Gas companies, naturally, have taken advantage of the situation to urge the merits and use of coke, their most important by-product. At the present time and also under normal conditions coke can be sold at a price 20% to 25% lower than stove or chestnut sizes of anthracite coal, even allowing for the lower heat value per pound of the coke. This is, of course, largely due to the fact that coke is produced from bituminous coal in the process of gas manufacturing and bituminous is invariably cheaper than anthracite.

Although impressed by the material saving in cost, many amateur firemen are skeptical of the satisfactory behavior of coke in ordinary furnaces and feel that they could not maintain comfortable conditions in their homes. They know that coke burns rapidly, unless the draft is very light; and they believe that it would be impossible to produce reasonably uniform warmth in a residence without more frequent attention than they can give.

The 30-hour continuous test reported in detail below was made to study the peculiarities and suitability of coke as a fuel in a small standard-type boiler designed for anthracite coal. Broken coke, furnished by the New Haven Gas Light Co., was used. This is about equivalent in size to a mixture of stove and nut anthracite. The test was made on a cast-iron sectional boiler which forms part of the house heating boiler test plant at the Mason Laboratory of Mechanical Engineering of the Sheffield Scientific School, Yale University.

VARIATION IN WEIGHT OF COKE.

Broken coke is sold by the New Haven Gas Light Company, at retail, by the bushel, fifty bushels being considered the equivalent of a ton. As coke absorbs moisture freely selling by weight would be unsatisfactory and might lead to misunderstandings with customers. The bulk of a ton will vary 10% or more, depending on the moisture content. In this particular test the coke averaged 47.84 lbs. per bushel, and the analysis gave 8.35% moisture and a heat value of 12,670 B.T.U. per pound dry. Fifty bushels, therefore, contained about 2,200 lbs. of dry coke. If anthracite coal, has a heat value of 13,000 B.T.U. per pound as purchased, fifty bushels of coke are equivalent in potential heat value to 2,140 lbs. of coal.

As a matter of interest and to furnish a basis for comparison a test of this same boiler with anthracite stove coal has been reported in adjoining columns to the coke test.

RESULTS OF COKE TEST.

The results of the coke test may be summarized briefly:

1. The overall efficiency of the boiler with coke is slightly higher than with coal; which is partly due to the smaller size of the coke, partly due to its burning more completely, and partly due to the lower output at which the boiler was operating. The coke requires more frequent attention to check holes developing in the fire bed. These holes are not large, but the air leaking through them would lower the efficiency somewhat if they were allowed to remain.

2. The coke charges in this test were about all the boiler could accommodate without losing steam pressure for too long a period to be satisfactory. With a firing of 175 lbs. pressure was lost for 20 minutes, on the average; when 225 lbs. were fired no pressure was shown on the gage for 40 minutes. With stove coal 250 lbs. can be fired at one time with no longer loss of pressure than for 175 lbs. of coke. Results are secured, of course, when operating at an output equal to at least 75% of rating.

3. From a financial standpoint heating with coke is about 20% less expen-

sive than with stove anthracite, and corresponds closely to the cost with pea anthracite. This latter fuel cannot be burned in many residence boilers, however, on account of insufficient draft. At the present prices, $7.75 for 50 bushels of coke and $9.75 for a ton of stove anthracite, the costs of fuel for serving 1,000 sq. ft. of radiation one hour would be $0.1045 and $0.145, respectively, which increases the relative saving of coke.

4. A coke fire in a coal furnace would not satisfactorily warm a house unless it received attention morning, noon, and night in ordinary winter weather, and every three hours in extreme weather. This statement is based on the supposition that the furnace is suited to the load it has to carry; i.e., is not very much oversize. The coke would require nearly twice the bin capacity and would be somewhat dustier in the cellar than coal. Offsetting these disadvantages is a saving of 20% in cost of fuel. A hot-water heating system tends to make larger firings of coke practicable by carrying, with its stored heat, the period during which pressure would be lacking in the steam system.

The following coke analyses illustrate the extent to which the moisture content varies. The decreasing proportion was due to storage in a heated building.

	1	2	3
Moisture	8.35	5.15	0.33
Volatile	3.58	4.58	3.10
Fixed Carbon	76.85	79.98	84.45
Ash	11.22	10.29	12.12

These analyses, reduced to a dry-coke basis, give:

	1	2	3
Volatile	3.92	4.83	3.12
Fixed Carbon	83.81	84.35	84.70
Ash	12.27	10.82	12.18

Data and Results of Evaporative Test of a House-Heating Boiler.

1. Test of cast-iron, sectional, heating boiler located at Mason Laboratory to determine characteristics of coke fuel, conducted by D. B. Prentice.
2. Kind of furnace: hand-fired, rocking grate. Depth, bottom of fire door to grate, 10 in. Mean height, grate to bottom of section above, 18 in. Fuel capacity at one charge on kindling fire, 225 lbs. coke.
3. Grate surface: width, 22.5 in.; length, 43 in.; Area, 6.75 sq. ft.
4. Water-heating surface: Direct, 24.13 sq. ft.; indirect, 78.1 sq. ft. total, 102.23 sq. ft.
5. Superheating surface, sq. ft. 17.4.
6. Date. Coke test, Dec. 23-24, 1914. Coal test, April, 22-23, 1913.
7. Duration. Coke test, 29.83 hrs. Coal test, 33.67 hrs.
8. Kind and size of fuel, Broken gas coke; anthracite stove coal.

			Coke	Coal
AVERAGE PRESSURES, TEMPERATURES, ETC.				
9. Steam pressure in boiler by gage	lbs.		2.86	4.0
10. Steam pressure in receiver by gage	lbs.		2.0	2.0
11. Temperature of feed water entering boiler	deg.		209	210
12. Temperature of escaping gases leaving boiler	deg.		353	...
13. Force of draft between damper and boiler	in.		.098	.14
14. Percentage of moisture in steam	per cent		0.3	dry
15. Percentage of CO_2 in escaping gases	per cent		7.	...
TOTAL QUANTITIES				
16. Weight of fuel as fired	lbs.		1,142	1,550
17. Moisture in fuel	per cent		8.35	2.92
18. Weight of dry fuel consumed	lbs.		1,047	1,504
19. Weight of ash and refuse	lbs.		109.5	...
20. Percentage of ash and refuse in dry fuel	per cent	(a)	10.5	...
21. Weight of water fed to the boiler	lbs.		8,890	12,950
22. Weight of water evaporated corrected for moisture in steam	lbs.		8,862	12,950
23. Equivalent evaporation from and at 212 deg.	lbs.		8,880	12,995

HOURLY QUANTITIES AND RATES			
24. Dry fuel consumed per hour	lbs.	35.	44.7
25. Dry fuel consumed per square foot of grate surface per hour	lbs.	5.18	6.62
26. Water evaporated at 16.7 lbs. absolute pressure per hour	lbs.	296	384
27. Equivalent evaporation per hour from and at 212° F.	lbs.	297	386
28. Equivalent evaporation per hour from and at 212 deg. per sq. ft. of water-heating surface	lbs.	2.9	3.78
CAPACITY			
29. Evaporation per hour from and at 212° F.	lbs.	297	386
30. Feet of radiation served (1 sq. ft. rad. equals 242.6 B.T.U.) sq. ft. rad.	sq. ft. rad.	1,188	1,544
31. Rated capacity in feet of radiation	sq. ft. rad.	75.5	98.2
32. Percentage of rated capacity developed	per cent	75.5	98.2
ECONOMY RESULTS			
33. Water fed per pound of fuel fired	lbs.	7.78	8.36
34. Water evaporated per pound of dry fuel	lbs.	8.47	8.62
35. Equivalent evaporation from and at 212° F. per pound of dry fuel	lbs.	8.5	8.64
36. Equivalent evaporation from and at 212° F. per pound of combustible	lbs.	9.5	...
37. Fuel, as fired, per hour per 1,000 sq. ft. rad.	lbs.	32.2	29.8
38. Dry fuel per hour per 1,000 sq. ft. rad.	lbs.	29.5	29.0
PROXIMATE ANALYSIS OF FUEL			
39. Moisture	per cent	8.35	2.92
40. Volatile matter	per cent	3.58	4.52
41. Fixed carbon	per cent	76.85	82.04
42. Ash	per cent	11.22	10.52
		100.00	100.00
EFFICIENCY			
43. Calorific value of 1 lb. of dry fuel, B.T.U.	B.T.U.	12,670	13,330
44. Calorific value of 1 lb. of combustible, B.T.U.	B.T.U.	14,420	14,960
45. Efficiency of boiler, furnace, and grate	per cent	65.1	62.8
46. Efficiency of boiler and furnace	per cent	...	...
ATTENDANCE			
47. Weight of fuel fired per charge	lbs.	175.	(b) 150-200
48. Weight of fuel fired per charge per square foot of grate surface	lbs.	26.	22, 29
49. Average interval between firings	hrs.	5.	3.3, 4.29
50. Minimum period of operation without attention	hrs.	1.	3.
51. Maximum period of operation without attention	hrs.	5.25	4.67
52. Nature of attention		(c) stopping hole in fire	firing
53. Character of fuel as regards handling, etc.		dusty	clean
54. Character of ash as regards handling, etc.		(d) light and fine	clean
55. Smoke observations		none	none
56. Soot deposits		slight	slight
COST OF EVAPORATION			
57. Cost of fuel per ton of 2,000 lbs. delivered in boiler room		$4.90	$6.75
58. Cost of fuel for serving 1,000 sq. ft. of radiation one hour		$ .079	$ .1003
59. Cost of fuel for evaporating 1,000 lbs. of water from and at 212° F.		$ .316	$ .4012
60. Notes			

a. The ash from ashpit was less than by analysis in the coke test probably because the fire was not shaken down to the starting thickness when the test was closed.

b. Approximately half of the coal test was made firing charges of 150 lbs. each, with charges of 200 lbs. each.

c. There was some tendency for the coke to clinker, but the clinkers were easily broken when a new charge was fired and they did not seem to affect the fire seriously.

d. The ash from the coke was very light and blew off from the shovel and out of the ash-barrel easily.

A Simple Method of Figuring the Economy of Humidity

Under all ordinary conditions where ventilation is carried on to any extent the drop in temperature allowable by artificial humidifying is not enough to conserve sufficient heat on the radiation end to evaporate the required amount of water necessary for the humidifying process. This is particularly true in any case where artificial ventilation or large air leakage is present. To make a statement that humidifying economizes the cost of heating is erroneous in all but a few very exceptional cases.

In comparing costs for a *general* statement on any matter it must be remembered that *average* conditions should be considered and *average* results compared. Now for residence heating it is generally agreed that without humidifying at all the inside air will have a relative humidity (at about 35° F.—average outside winter temperature) of about 40%. The writer has also verified this by actual experiment. Now with 35° outside temperature, 40% inside relative humidity and, say 70° inside temperature we have average conditions attained in residences during winter weather.

It is not believed that many would advocate raising the inside relative humidity to over 60%. If this is taken as a desirable limit the increase in humidity at 70° could not exceed 60% minus 40% or 20%. 8 grains x 20% = 1.6 grains per cubic foot to be added to the air.

According to the "Comfort Zone" chart of Dr. Vernon Hill 70° F. and 40% relative humidity comes just a trifle above the center line of the "zone of comfort" as defined by thousands of experiments. Therefore, at a point the *same* distance above the *same* centerline, but at 60% relative humidity would be shown the temperature which the majority of people would consider as being equivalent with the increased humidity, or 65°. Therefore, the allowable drop for equivalent sensible heating effect would be only 70° — 65°, or 5°.

With 70° inside and 35° outside, the temperature difference is 70°—35°, or 35° and with 65° inside and 35° outside, the temperature difference is 65° — 35°, which equals 30°, or 5° less. Therefore the radiation saving for average conditions would be

35° : 5° : : 100% : x This equals 14 1/3%.

With an average outside temperature during the winter of 35° the average hourly efficiency of 1 sq. ft. of radiator surface would be 250 x 35/70 or 125 B.T.U. This is accomplished by turning the steam in the radiator on and off during mild weather, making a maximum efficiency when "on" of 250 B.T.U. per square foot per hour and an efficiency of zero when "off," the average efficiency being 125 B.T.U., as above stated.

Then a saving of 14 1/3% under average conditions would mean a saving of 125 x 0.14 1/3, or 18 B.T.U. per square foot of radiator surface.

As the living rooms of a residence seldom have an air change of more than once per hour it can easily be computed how many cubic feet of air in the room can be humidified by this saving from 40% to 60% relative humidity.

Each cubic foot under such conditions, as already shown, requires the

addition and evaporization of 1.6 grains of water or 1.6/7000 pounds of water which, to evaporate, requires about 1000 B.T.U. per pound, or $1.6/7000 \times 1000 = 1.6/7$ B.T.U. per cubic foot. Since we have 18 B.T.U. for every square foot of radiation each square foot will take care of $18 \div 1.6/7 = 18 \times 7/1.6 = 80$ cu. ft. approximately of contents.

From this it can be seen that if the ratio of radiator surface to the cubic contents is about 1 to 80 the saving would about equal the loss at one air change per hour, but if the cubic contents exceed this or if the ventilation carried on in cubic feet per hour exceeds this one air change there will be a loss; if, on the other hand the cubic contents is less than 80 cu. ft. to each square foot of radiator surface then there will be a saving. Such ratios, however, are rare and would only apply to small unventilated rooms with comparatively large heat losses.

Typical Details For Hot Water, Steam and Hot Blast Heating

By T. W. REYNOLDS

While the general run of engineering practice follows well-known grooves, there are nevertheless many individual schemes or "kinks" that have been found to work out successfully in practice. Some of these are presented herewith, taken at random from many years of personal experience.

Fig. 1 is a detail of the connections as made for an installation of two expansion tanks. The tanks in this particular case are 30 in. in diameter by 54 in. long and are equipped with a water gauge at one end and a manhole at the other. The tanks are connected by a 4-in. equalizing pipe from the center of which is extended a 3-in. vent to the atmosphere and a 3-in. overflow to the nearest rain-water conductor. It is best, however, to extend the overflow to a point over a slop sink so that it may drip openly and disclose any leakage into the heating system from the automatic water feeder. A 1-in. circulating pipe should be connected to the bottom of the tank and used also as an air vent from the risers. The cold water supply is automatically fed as required through the automatic device which is shown equipped with an equalizing pipe and by-pass, all of 1 in. pipe. The expansion pipe is 2½-in. in size.

In Fig. 2 is shown a good design for a trench curb and covers for use in piping work. Two types of cover are shown. Those of wrought iron should be of the checker pattern. These covers are of ¼-in. wrought-iron plate, either with turned-down edges or reinforced with 1-in. x 1-in. x ⅛-in. angle irons, as shown. The latter cover should have rivets with flush heads. The 2-in. x

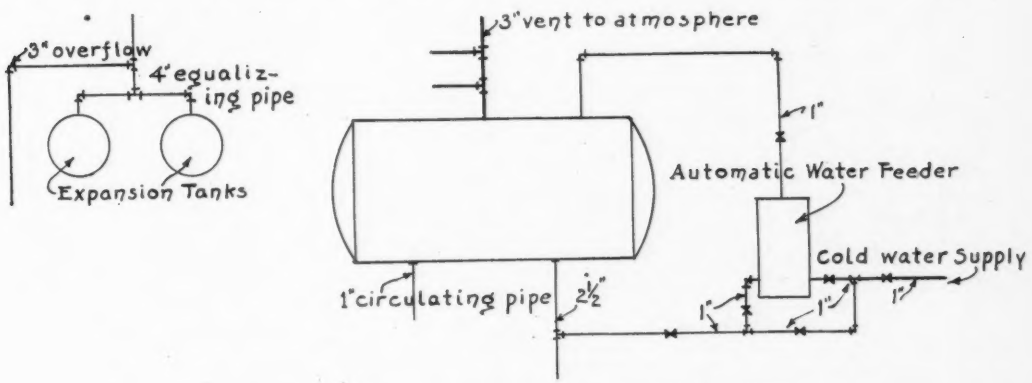


FIG. 1.—TYPICAL EXPANSION TANK CONNECTIONS.

1½-in. x ¼-in. tee irons are anchor-bolted to the concrete every 18 in.

RADIATOR DETAILS.

Fig. 3 shows a fresh air intake suitable for operating rooms. The box

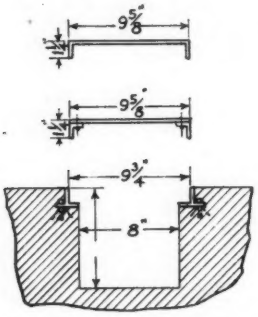


FIG. 2.—DETAIL OF TRENCH CURBS AND COVERS FOR PIPES.

coil is shut off from the room by means of glass or marble, except for the opening along the bottom which provides for the recirculation of air when the damper in the intake is partially or wholly closed. A locking device is arranged inside of the room, with a chain extended so as to control a felt-lined and weighted damper in the intake box. The chain and locking device are of nickel-plated brass. Copper louvres are provided and set in the 6-in. x 16-in. galvanized-iron intake box.

Where the plans call for recessed radiators an arrangement as illustrated in Fig. 4 may frequently be used. The detail shows a recessed radiator, with temperature control valves, enclosed in a lining of No. 22 B. & S. galvanized-iron sheet metal and ½-in. asbestos sheets. An air inlet slot is provided at the bottom and a grille at the top, set

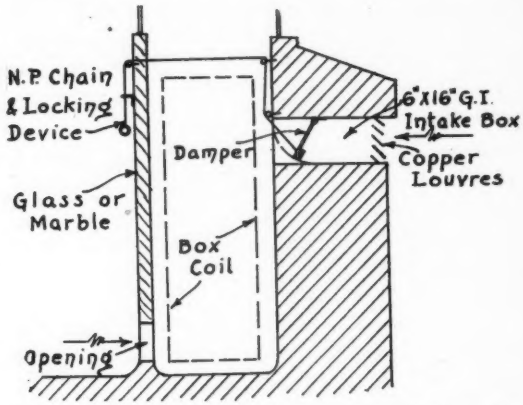


FIG. 3.—DETAIL OF FRESH AIR INTAKE TO RADIATORS.

so as to be easily removable for cleaning. The legs of the radiator rest upon 2-in. blocks.

Speaking of radiator supports, Fig. 5 shows a detail of a cast-iron support for the bottom of radiators. These brackets should be set so that the distance from the floor to the lower edge of the radi-

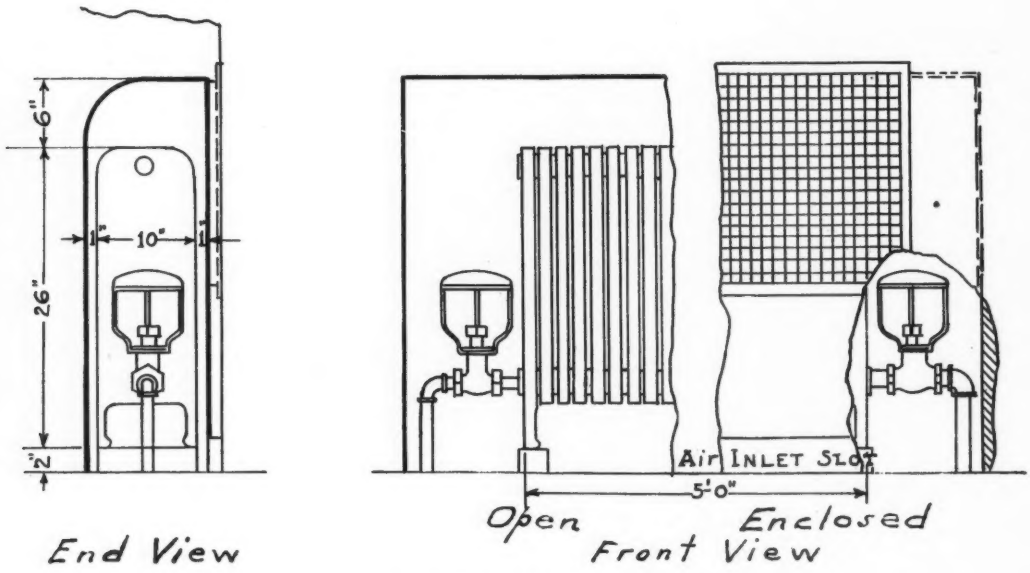


FIG. 4.—ARRANGEMENT OF RECESSED RADIATORS.

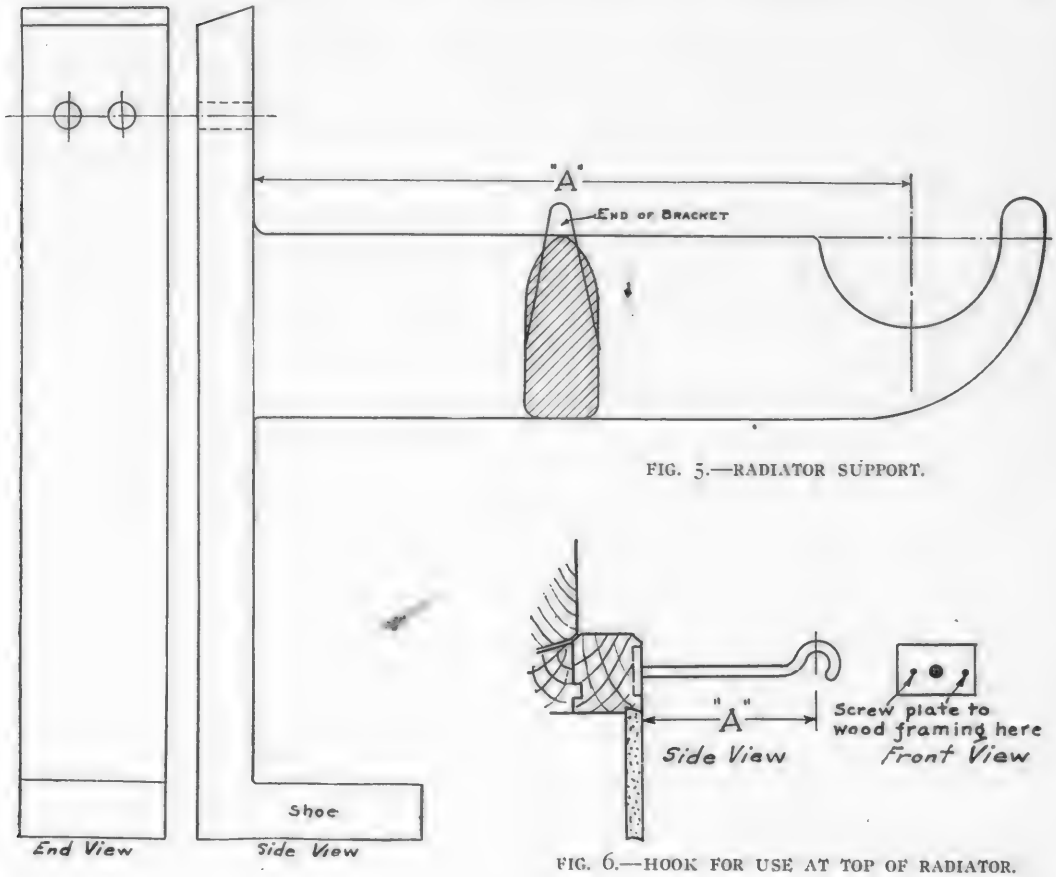


FIG. 5.—RADIATOR SUPPORT.

FIG. 6.—HOOK FOR USE AT TOP OF RADIATOR.

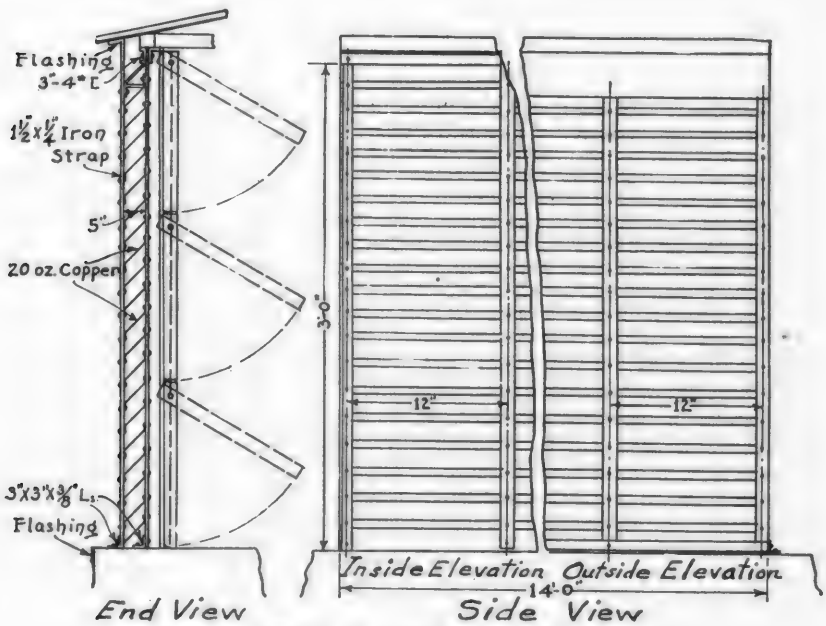


FIG. 7.—DETAIL OF FRESH AIR INLET LOUVRES.

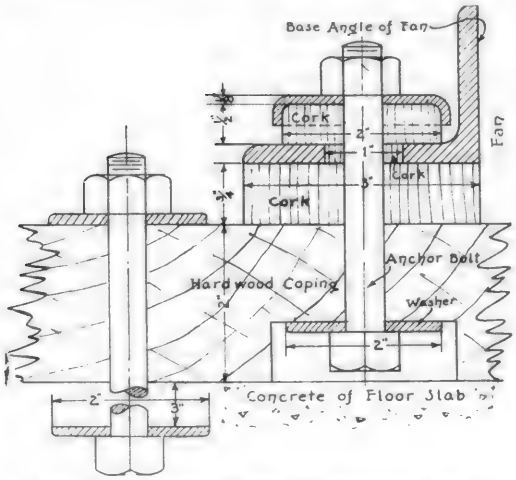


FIG. 8.—METHOD OF SOUND-PROOFING FAN FOUNDATIONS.

ator is 5 in. The distance from the wall to the back edge of the radiator should be 3 in. This determines dimension A. Brackets may be screwed into wooden framing or bolted into masonry so that the edge of the bracket will be flush with the plaster finish of the room. Fig. 6 is a detail of a hook to be used at the top of the radiators.

FAN AND AIR DAMPER DETAILS.

The detail shown in Fig. 7 illustrates a fresh air intake with fixed louvres as designed in connection with the mechanical supply of a ventilating system. Shut-off dampers are also provided, as shown. The louvres are of 20-oz. copper, being riveted to vertical 1½-in. x ¼-in. iron straps. The latter are secured to 3-in. x 3-in. x ⅜-in. angles at the bottom

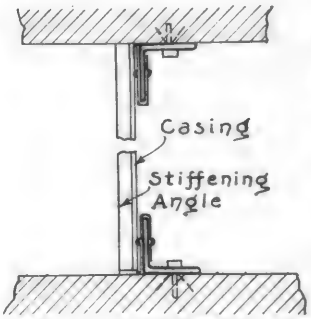


FIG. 9.—CONNECTIONS OF FAN ROOM CASING TO FAN ROOM FLOOR AND CEILING.

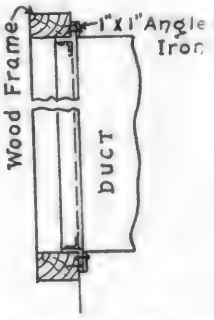


FIG. 10.—METHOD OF FASTENING SHEET METAL FLUES TO VERTICAL PLASTER FLUES.

and to 3-in. 4-lb. channels at the top, flashing being used both at top and bottom.

A good method of sound-proofing fan foundations to prevent the telephonic transmission of sound is illustrated in Fig. 8. To accomplish this it is essential that the fan be isolated from its foundation. It will be noted from the

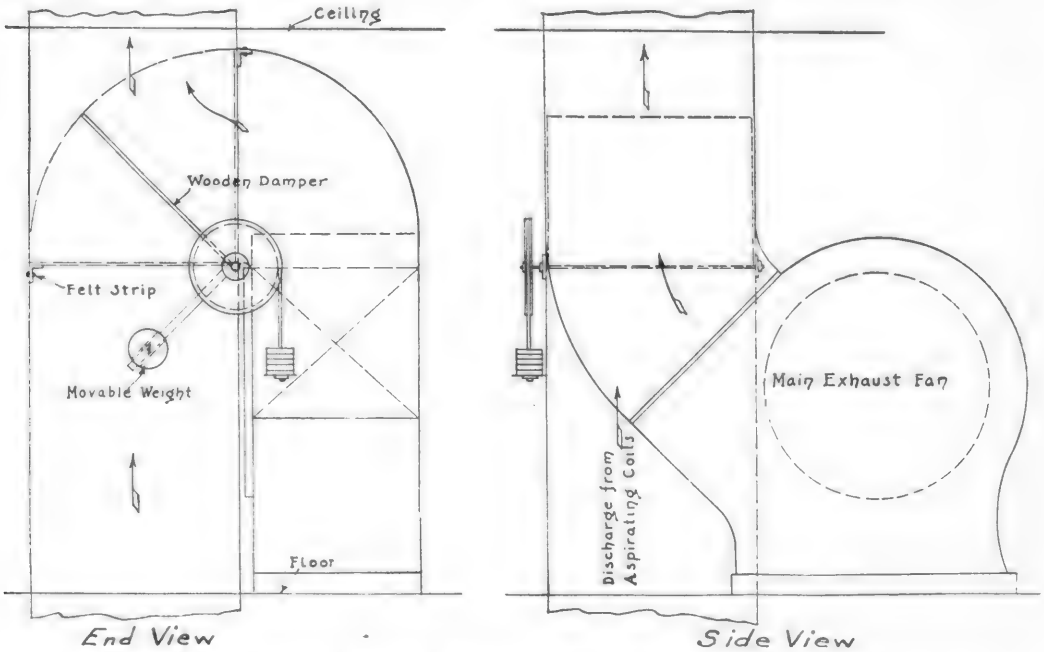
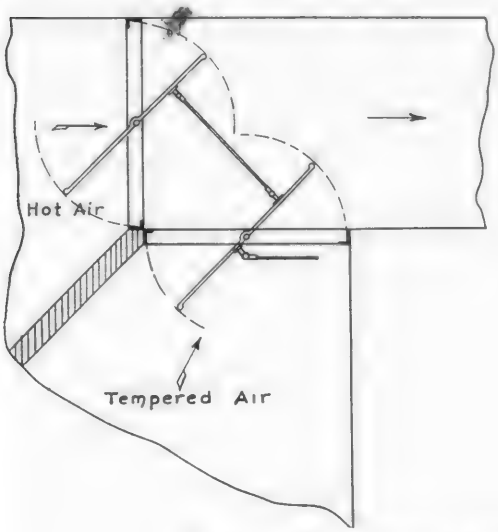
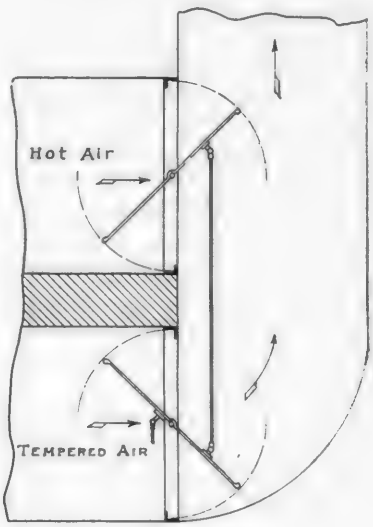


FIG. 11.—DETAIL OF DAMPER BETWEEN DISCHARGE DUCTS FROM FAN AND ASPIRATING COILS.

sketch that the metal of the fan and its base are prevented from coming into contact at any point with its foundation or anchorage bolts. Cork is the material used, together with a hardwood coping, bolted in turn to a steel beam or to the concrete of the floor slab.





FIGS. 12 AND 13.—TYPICAL DAMPER SETTINGS AND CONSTRUCTION.

In making sheet metal connections in fan rooms, a satisfactory method is shown in Fig. 9, indicating how the fan-room casing is connected to the fan-room floor and ceiling. Stiffening angles are

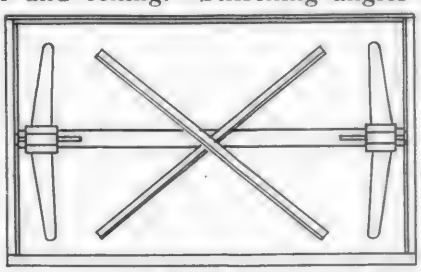


FIG. 14.—DAMPER, WITH REINFORCING STRIPS.

used, with 2-in. x 2-in. x 3/16-in. angle-iron anchors bolted to floor and ceiling. The connections between the latter and the angle iron are made tight by means of cement grout or asbestos wicking. Fig. 10 shows a method of fastening sheet metal flues to vertical plaster flues so as to make an air-tight joint.

Coming to the subject of dampers, Fig. 11 illustrates a detail of a damper between the discharge ducts from the fan and aspirating coils. The damper is weighted, as shown and set between two discharge ducts, one from the fan and the other from the aspirating coils. The damper is arranged so as to close the connection from the aspirating coils while the fan is running. When the fan stops, the connection to the discharge duct is closed and ventilation by aspiration only is assured. Wood is used in the construction of the damper in the form of two ¾-in. boards covered with tin and arranged so as to close on felt strips. Adjustments may be made by means of the movable weights on the lever attached to the damper, the number of weights acting on the wheel being as required.

Typical mixing damper settings for hot and tempered air are illustrated in Figs. 12 and 13, while Fig. 14 shows

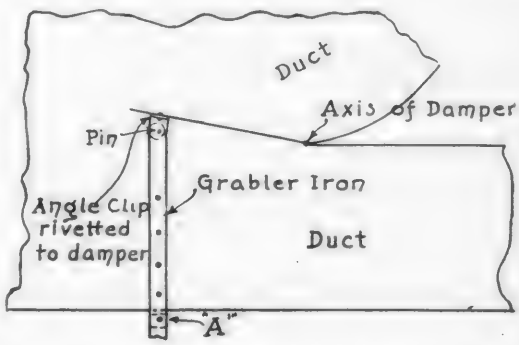


FIG. 15.—METHOD OF FASTENING AIR-REGULATING DAMPERS IN POSITION.

good practice for damper construction. The latter sketch shows the reinforcing strips used, while the two former the rolled-edge construction is followed, which serves to protect and stiffen the dampers.

The fastening of air regulating dampers in position is also an item of varying practice. A convenient method of doing this, where the dampers are to be placed in ventilating ducts, is shown in Fig. 15. When the correct position of a damper has been found, it can be bolted at the point A, and the end of the grabler iron sawed off. Angle clips are riveted, one to the duct at the point A and another to the damper at the point shown.

A good design for a three-blade louvre damper used as a fresh air intake is illustrated in Fig. 16. The frame is made up of a 2-in. x 5/8-in. channel weighing 2 lbs. per foot, the operating mechanism being constructed of 1/8-in. pipe using right and left-hand fittings. Intermediate connections are tapped and threaded 7/16 in., 20 R, to L. The blades are of No. 22 or 24 gauge galvanized-iron, according to size and are braced with 5/8-in. x 1/4-in. bar iron or 1-in. x 5/8-in. x 1/8-in. angle iron (long leg up) according to area and proportions.

Blades which are long enough to be inclined so as to sag should have angle-iron supports running lengthwise. The edges of the blades are weighted so as to prevent them from sticking and buckling. This method also serves to stiffen the blades and make them easily movable. Felt strips are used as shown. The construction as here outlined provides for substantial louvres, suitable for steady operation and permanency.

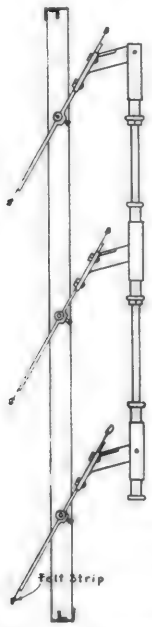


FIG. 16.—DESIGN FOR THREE-BLADE LOUVRE DAMPER.

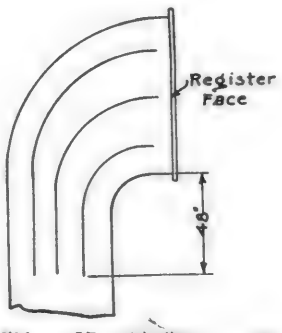


FIG. 17.—GENERAL ARRANGEMENT OF INTERNAL DIFFUSERS.

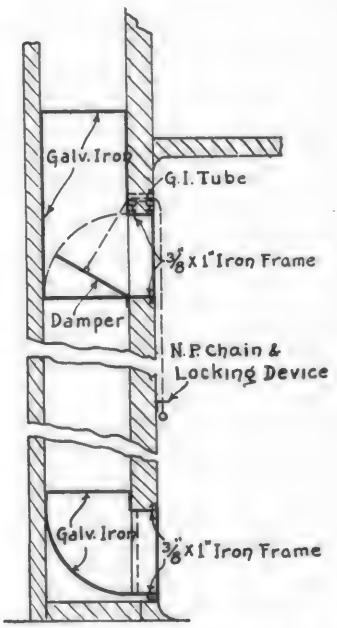


FIG. 18.—SHEET METAL CONNECTIONS TO PLASTER FLUES.

Finally, in the matter of register faces the accompanying sketches, Figs. 17 and 18, may offer useful suggestions. Fig. 17 shows a general arrangement of diffusers as extended back into the ducts from the register faces. Fig. 18 shows a typical sheet-metal connection to plaster flues from top and bottom room-inlets and outlets. The upper or supply inlet has its flue extended above the register face for a short distance in order to cushion the air.

A Practical Plan of Engineering Co-operation

By F. H. NEVELL.

Head of Department of Civil Engineering, University of Illinois.

From an Address before the Cleveland Engineering Society.

Out of the white heat of the devouring conflict in Europe a new world is emerging. We are being included in that new world, and are in the midst of great changes in methods and ideals. As engineers, as "men of ingenuity," we must have the clear vision to see what is coming, to recognize the new conditions and to maintain a leadership in the larger activities for the common good.

The traditional engineer is accused of being conservative, of taking the safe side, of assuming a factor of safety disproportionately large and of proceeding with a caution which verges upon fear, especially in connection with conditions outside of his immediate line of experience. In spite of this the engineers as a body are awakening.

The conspicuous outcome of these changes is a larger recognition of human agencies in engineering work. In the past the engineer has thought almost wholly in terms of materials; he is now appreciating more than before that the efficiency of his machines is dependent not only upon the quality of the steel and speed with which the tool operates, but even more than this upon the spirit of the man who is behind the tool.

We have been studying and conducting researches into the methods of securing the highest degree of efficiency out of the machine, overlooking the fact that with the very best equipment and the finest organization, we cannot attain the maximum result unless we have the men with us, unless they feel that they are not merely part of the machine but are being treated as men and are being afforded an opportunity to live their lives according to their highest ideals. The spirit of the men counts for more than the design of the machine.

RESTLESSNESS AMONG ENGINEERS.

There is a restlessness throughout the great body of engineers in this country due to the fact that they dimly realize that they are not well placed. This restlessness is necessarily an accompaniment of the change in conditions and in ideals. Out of this restlessness is coming a discussion of the broad question as to where the engineer stands in relation to the rest of the world. Is he performing his full part? Is he living up to the best that is within him? Especially are the organizations to which he belongs doing their best or are they simply moribund relics, outgrown shells of former habitations? Are they cramping the spirit of progress or are they sufficiently elastic to be adapted to our rapidly growing needs, especially those of wider human relations?

To answer these questions we must get together and talk them over. It is not possible for any one man or group of men to survey the whole field and to decide as to whether the engineers and their associations are following the more direct path in their leadership in the world's material progress. There must be an exchange of ideas, a co-operation, a working together of many minds and of many scattered forces.

An engineering society is simply an individual grown large with indefinite length of life. It is subject to very much the same laws, and if the individual finds that it strengthens and broadens him and makes him a better man in the community to get together with his neighbors and to exchange experiences, so, in like manner, the society is strengthened and improved in the efficiency of its work by meeting with other societies of like aims. Efforts are stimulated, new ideas brought forward and the progress is increased in geometrical ratio as the number of these organizations which get together is increased.

It is, of course, impracticable for each society as a whole to meet with a similar society from a neighboring city or State, but excellent results are found to flow from an exchange of visits of a few delegates and even greater from a still wider exchange of experience in the case of delegates from organizations from many cities and States.

METHODS OF ENGINEERING SOCIETIES UNDERGOING CHANGE.

The stated object of an engineering association is usually the advancement of engineering knowledge and practice and the maintenance of a high professional standard among its members. Each new society at its birth has adopted largely the forms and methods of the older bodies, often unconsciously copying precedents which the more mature society would be glad to drop and overlooking the unrecorded improvements which have taken place. For example, when the first engineering organizations were formed, there was demand for the publication of technical papers; many of the associations thus practically became publishing houses for material much of which now might be printed to better advantage elsewhere. Their energies are often being expended in uneconomical ways.

The growth of the technical press, with its machinery for presenting quickly and concisely to the engineering profession and to the public at large the latest discoveries and the most recent achievements, has made unnecessary much of the work which was originally performed by engineering societies. Nevertheless, many of our newer associations persist in following along the old beaten track of publishing papers, not lifting their eyes from the ground and seeing the great neglected needs around them. Much of the money thus misused might better be expended in getting men together to discuss the present status and tendencies of affairs and to consider how best to help each other and the world in general, incidentally promoting the social features which are so vital in all human affairs. You as an organization are leading in this better direction, so that it is only necessary to add that your example has been of great value to other organizations.

MOST SOCIETY MEMBERS NOT STRICTLY PROFESSIONAL MEN.

The moment we recognize clearly the fact that the men who join the engineering societies as yet are not professional men although looking forward to that condition, then it follows that we must modify our organization and methods to accomplish the largest good to the greatest number. With this condition in mind, namely, that, while some may be professional men in the strict sense of the word, yet the great majority, particularly of our younger men, are not professional, but are more of the nature of wage earners, we must look around us and see what similar organizations of other men are doing. We must try to help each other by an exchange of ideas, by an exchange of experience, so that we as an organization may perform our full duty, not only to our own members, but to the public in general.

EMPLOYMENT.

The first thing, the thing that all must have, is a job. We must have employment. We cannot all start in life as professional men, picking out our work and stating what our compensation shall be. We have got to grow up to that status. In the meantime we must live, and if there is any one thing which an engineering society has as a duty to its members, it is to assist them in securing employment. If you stop to consider it, practicaly every one of us at some time or another is out of a job.

More than that, as we are out of a job perhaps only once or twice in a decade, we are of all people the most helpless when we are out of work. The highly trained and educated man is peculiarly unfortunate under these conditions. The mechanic is out of work more frequently. His comrades recognize this fact and do their part. The machinery of modern industry, while crude and inefficient in the matter of employment, does operate after a fashion for his benefit. He knows how to go about to get work, and it is no disgrace to him to be out of employment. Every one of us, when we are out, feel that it is a disgrace to let the fact be known. We are dazed. And if there is any one thing that the organization of our associates should feel incumbent upon them, it is to help the fellow member to do the thing which he cannot do himself, and to make it possible for him to get employment at proper compensation just as quickly as he can.

It is a most pitiable condition to see

such men accepting mere living wages, men of high ability, high attainment, because of an inherent modesty, a condition cultivated by the engineering ideals. All should unite in intelligent, well-directed consideration as to how to help our fellow member to be better treated when the critical time comes. We can say things for him that he cannot say for himself and that he cannot ask us to say; it is one of our duties as men and members to look into employment systems as we never have in the past, because as has been said, the times have changed, and the conditions of employment now and in the future are getting more and more stringent. This is particularly the case for some of the older men. For them the line is often drawn rigidly at forty-five years of age. Any man over that line is not employed. It is a cruel and often unnecessary situation. This and other injustices can be cured, if at all, only by the united effort of an organization of this kind and by your co-operating with other organizations in similar work throughout the country.

Every day that one of the men who make up the rank and file of an engineering society is out of work is a loss not merely to him and his family, but also to the community. It is a duty as yet only vaguely recognized on the part of the society to see to it that the brother member secures congenial employment at the earliest practicable date. The traditions of the engineering profession, and the unwritten laws seem to penalize the unfortunate engineer who is not immediately employed on the conclusion of one enterprise or on the sudden termination of his former connections. Individual and professional pride prevent him from going outside of the circle of his people. To do this we must propagate throughout the country the kind of publicity which enables the public to know and appreciate what has been done, and to give to the engineer the standing which men of brains deserve, and which they do not get if they do not let the world know what their individual members are doing for the public service and for the up-building of all humanity.

Professional men shy at the word publicity and "go up into the air" at the idea of advertising. The older professions frown upon self-sought publicity. Nevertheless, they have seen to it that the public is at all times kept informed of their activities not as individuals, but as professional men ministering to the needs of humanity.

Many engineers have not been able to clearly distinguish betwen self-seeking advertisng and the proper and necesary publicity or diffusion of information regarding engineering achievements. They have assumed that publicity meant the advertising of some one man or some scheme for personal advancement. They have overloked the fact that the engineers as a whole cannot perform their full duty to the community until the community is well informed concerning what has been done and, more than this, what can be done. The public uninformed little knows of the infinite variety of devices perfected by the engineer which have improved health, comfort and prosperity. While the individual engineer may not properly exploit his own performance, yet the association of which he is a member has a duty to itself, to the public and to the members to put out clearly and frequently statements acceptable to the daily press which systematically bring about the proper appreciation of engineering work.

BETTER LAWS.

The third line in which our engineering organizations should co-operate is that which will bring about improved civic conditions, through better laws. In this we have held back. We have thought that the law was something with which a respectable engineer should have nothing to do. In a letter recently received from a distinguished engineer, a very charming man, the statement was made in effect: "We engineers should not trespass on the domain of the law maker." That sounds rather queer, think it over—the domain of the law maker. Who is the ideal law maker? Surely not the lawyer. His business is to interpret the laws, to find out what the law is and to stay within it. He has rarely the constructive imagination to devise good laws. It is true that the majority of our law makers are lawyers; and also that our lawyer-made laws are something to which we do not always point with pride.

Who is the law maker? The law maker should be the man of sound information coupled with vision; if any man is a law maker by right, it should be the engineer; instead of encroaching upon the domain of the law maker, it is the proper domain of the engineer to suggest and to outline future laws not on the basis of what they have been, but what they should be, as determined by the careful investigation of educated men who are studying the facts and not the theory which existed in the minds of the ancients.

Society can make little progress until the man-made laws restricting progress are revised to meet the exigencies of modern changing conditions. In this work the engineer has been singularly remiss. His thoughts have run almost wholly upon materials and he has kept aloof from the human relationships which now seem to be so vital in the full use of these materials. The ordinances of the city, the acts of county commissioners, the laws of the State and of the nation, have been framed mainly by men who have not had the broad vision which should be possessed by the engineer.

ETHICS.

Our professional men, the men who devote their lives to the highest good of the community and whose greatest reward is not in their pay but in the performance of duties to the commonwealth must be protected from the cheap man, the bungler, the charlatan, the quack, the man who is trying to commercialize the profession. To do this we must have and must enforce an ethical code.

Ethics is a word which has been too little heard at meetings of engineers. We know that there is such a thing and that in the profession of law and medicine the local organizations are frequently discussing and applying the principles of their ethical codes. They have found it absolutely essential to protect the man who puts the practice above the pay from the person who would drag him down and literally starve him out. By experience they have learned that the syster, and the chalatan easily get the ear of the public and if not restrained will reduce the profession to a mere trade. The highly skilled man devoted to his profession in many lines would be practically unknown, were it not for the fact that the horde of cheap men were held in check by the enforcement of a firm code of ethics.

"It is not enough to set forth a code of ethics as a lamp to straying feet. It is necessary to make it worth while for wobbly practitioners to live up to the code."

"Mere moral suasion no more suffices to keep the professions straight than public opinion suffices to keep the peace. In either case, tribunals and punishment are necessary. The good in each of the professions ought to be organized in order to pursue and harry the bad."*

As has already been said, ethics has not been enough considered in our societies. We have assumed that the average engineer is an honest man or he would not be an engineer, and we have permitted the consideration of ethics to drop in the background. There is no one thing on which the engineer can cooperate more effectively to the profession than in the consideration of ethics, the discusison of codes and the enforcement of these by local associations. You know your local conditions, you know your local men; and if any man falls below the proper standard, he should be tried by the men of his own profession on the ground, who can give to him the justice to which he is entitled. One of the things that we have missed, and one that we must take up in the future to meet the changing conditions is the handling of the ethics, in a brave, clear, clean way, to protect the men of high ideals from the encroachment of the less scrupulous men.

NATIONAL SOCIETIES.

To bring these things about, you cannot act alone or try uncertain experiments. To attain certain results, you must have behind you the profession in general, and the backing of other local organizations.

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* See "The Making of the Professions," by Edward Alsworth Ross, in the International Journal of Ethics, October, 1916, pages 67-81.

In what has been said reference has been had mainly to the city or local organizations. Each of you as engineers has this duty of building up and strengthening your own local organization. In the same way the engineers resident in every other city or locality have a similar duty. In doing so, however, they should not overlook the claim of the great national organizations with headquarters in New York. They have their distinct place in outlining and maintaining the ethics of the profession and in setting standards. Each of us as a citizen of our municipality and state and also a citizen of the United States has certain distinct duties. So as engineers, while our immediate interest lies around us, yet we must not forget the fact that we are, or should be, a part of the great national body.

First build up and help build up a local engineering society in each and every locality where a score or more of engineers are gathered together, assist those men to organize, to look after the local questions of engineering in general and also of employment, of legislation, of proper education of the public, and of enforcement of ethics. At the same time, each of us as a citizen of the larger world represented by the great national technical societies, after having discharged our duties to the local society, should try to join one or another of the national organizations, and, more than that, should endeavor to bring those together in unity of action, perhaps not in actual coalescence, but in unity of ideals, selecting standards for our local societies.

Recent Progress in the Use of Gas for House Heating

With Data Showing Amount of Gas Required to Heat a Given Building.

An interesting compilation of data has recently been made by a committee of the American Gas Institute on the subject of present gas heating systems. George S. Barrows, manager of the gas heating department of the general Fire Extinguisher Co., Providence, R. I., is chairman of the committee.

The report deals first with hot water heating systems using gas exclusively. Records of eight such systems are presented. All are residences. The total cost of gas fuel for one season was $268, $234, $281, $204, $632, $493, $120 and $131, respectively. The estimated cost of coal for the same buildings is given as $180, $187, $225, $240, $502, $502 and $120, respectively, a comparison with the last building being omitted.

The estimate as to the coal cost was based upon 2¾ tons being required per 100 sq. ft. of radiation per season.

The next group includes four buildings equipped with steam heating systems, using gas exclusively. The gas heating costs ran as follows: $506, $1,093, $359 and $169, respectively, as compared with an estimated cost, using coal, of $277, $682 and $112, respectively, figures for the last building being omitted. It will be noted that in each case the cost of gas fuel is considerably in excess of that estimated for coal, although this difference, it is pointed out, would be decreased by the addition of labor charges, etc.

HOT AIR SYSTEMS.

Data were secured on two systems using gas-fired hot air furnaces. Here the total cost of gas fuel was $253 and $348, respectively, as compared with an estimated coal cost of $300, in each case. The price of gas in these cases was 54 and 53 cents, per 1,000 cu. ft., respectively.

GAS STEAM RADIATORS.

Under this heading a number of cases are cited of operation results with gas steam radiator installations. In these tests a heating effect for a season per 100 cu. ft. was secured at a cost as low as 5½ cents, although the average was generally about 48 cents. With portable heaters similar results were secured.

The report then took up the Rector

system. It was stated that many of the difficulties which have been encountered in the use of the Rector system are due, in large part, to poor mechanical construction and lack of organization on the part of its backers. In spite of these odds, states the report, there are many satisfied owners of Rector installations. A very successful manufacturing and construction organization has recently lent its hand in improving and marketing this appliance and it is likely observes the report, that the mechanical faults shortly will be remedied. According to the records of several Rector systems the total cost of gas fuel in one case was $406 compared with a previous coal fuel cost of $280; and in another case $451 as compared with a previous coal fuel cost of $225.

AMOUNT OF GAS REQUIRED TO HEAT A GIVEN BUILDING.

From the data obtained the committee arranged a summary table, which is given herewith, showing the amount of gas required to heat a given building, or part of a building, under certain known conditions. In making up this table only such data as pertained to systems in use for one or more complete heating seasons were used. These data have been separated with reference to the type of heating plant, building occupancy and the locality. All figures relative to gas consumption are in terms of cubic feet of gas required per heating season per 100 cu. ft. of building contents heated. When more than one installation of a kind occurs in the same locality and in the same class of building, the total number of such cases used in working out the average fuel requirements, together with the maximum and minimum fuel requirements of the group, are tabulated. In some of these cases it will be seen there is only a small percentage of variation between the maximum and minimum fuel requirements.

An important section of the report is devoted to heating systems using gas fuel as an auxiliary. In this connection it is pointed out that the attempt to adapt gas burners to existing coal heaters can have but little commercial success and in many instances will, no doubt, prove costly to the gas company. The committee carefully considered the use of heat regulators in connection with gas fired heaters and believes that they should be recommended in every case for their convenience and utility. It is probable, adds the report, that but little actual saving in gas, if any, will result from the use of heat regulators, but they will materially improve the service.

HOW THE GAS COMPANIES ARE PUSHING AUXILIARY HOUSE HEATING APPARATUS.

The following information for canvassers is used by one large gas company:

The gas hot water heater and gas steam heater will heat a house satisfactorily with but little more cost than coal during the early fall and late spring months. Some people are so pleased with the cleanliness and convenience of a gas heating equipment that they continue its use during the entire winter, willingly paying the extra cost over coal for the comfort of the gas heating system.

As a rule the gas company should not advise the use of gas central heating plants for the entire house in winter months, as this work can be done then at less cost by the regular coal furnaces, but the small extra cost of gas heating in the early fall and late spring (sometimes it is cheaper than coal) is well worth paying to take advantage of the cleanliness, comfort and easily controlled heat given by gas-water, and-steam "central" heating plants.

It is possible, by use of a thermostat, to carry an even temperature in a house with the minimum cost.

Every one knows the difficulty, in early fall and late spring, of keeping a fire constantly in the coal heater and at the same time keeping the house comfortable. It is too hot during the day and damp and cold at night. This unpleasant, unhealthful condition is entirely eliminated by the use of a gas-fired steam boiler or water heater. Many of the annoying colds due to wide variations in house temperatures, will be avoided by the even, uniform heat of a gas fired plant controlled automatically by a thermostat.

In this case the gas company recom-

GAS REQUIRED TO HEAT VARIOUS TYPES OF BUILDINGS.

(Figures Show Cubic Feet of Gas Used per Heating Season per 100 Cu. Ft. of Building Contents Heated.)

Type system. Max., Min., and Aver., c. ft. gas required per season per 100 c. ft. contents		Residences								Small Ap'rtments	Small Stores.		Offices.	Tel. & Tel. & R. R. Ticket Offices.	Ch'es.
		Baltimore, Md.	Brooklyn, N. Y.	Newark, N. J.	Rochester, N. Y.	Savannah, Ga.	St. Louis, Mo.	Toronto, Can.	Worcester, Mass.	Toronto, Can.	Newburgh, N. Y.	Savannah, Ga.	Savannah, Ga.	Savannah, Ga.	Savannah, Ga.
Hot Water	No. cases						3								
	Max.						1710								
	Min.						1140								
	Aver.						1328								
Steam	No. cases						2		1						
	Max.						1655		2513						
	Min.						1500		2513						
	Aver.						1602		2513						
Hot Air	No. cases						2								
	Max.						1233								
	Min.						860								
	Aver.						1043								
Gas Steam Radiators	No. cases			2							5	4	3	2	2
	Max.			2240							1805	154½	122	491	87
	Min.			2065							703	70	117	424	50
	Aver.			2158							644	116	117½	445½	58½
Portable	No. cases		1			1						2			
	Max.		700			393						127			
	Min.		700			393						124½			
	Aver.		700			393						125			
Rector	No. cases	2			1			1	1	4					
	Max.				929			2465	1176	2124					
	Min.				929			2465	1176	780					
	Aver.				929			2465	1176	1488					

mends the use of a specified type of gas steam boilers and gas water heaters. The heaters are of ample capacity to furnish the necessary heat to take care of the radiation surface for which they are listed. The coils are copper—and are large in diameter, insuring rapid circulation and the interior is smooth, to insure freedom from obstruction. The coils are arranged to have the steam and hot water leave the heater at the hottest part of the flame, insuring highest temperature and efficiency.

The burners are well made, equipped safety door which shuts off the gas supply when opened, making it free from any danger in lighting. The coils are readily removable and can be plugged with ordinary screw plugs when temporarily removed, thus continuing the heater in operation.

The burners are well made, equipped with easily-adjustable outside air mixers and removable brass tops covered with gauze to prevent flashing and insure perfect combustion.

(Here is given some detail information regarding heater sizes, tappings, etc.)

This gas company installs a thermostat equipped with a reliable eight-day clock, the mechanism being so arranged that at night the thermostat pointer is moved back automatically to the night temperature and again in the morning, at the predetermined hour, is moved forward to the day temperature. As the hand set at the predetermined hour is brought to the top by the revolving dial, the hand comes in contact with a small lever, tripping a mechanism which moves the thermostat pointer entirely independent of the clock. The lever resumes its original position and is ready for the next operation.

The time set is changed readily. The range of the automatic throw is adjustable both backwards and forwards. The thermostat pointer can be moved at any time entirely independent of the clock mechanism without affecting the automatic action.

The gas company will obtain estimates from steam fitters for installing a heater on plans furnished by the gas company and will submit steam fitter's bid for installation to the prospect, together with an estimate of the cost of the heater and thermostat. In each case the agent will write a letter definitely stating the cost and terms so that no misunderstanding can arise.

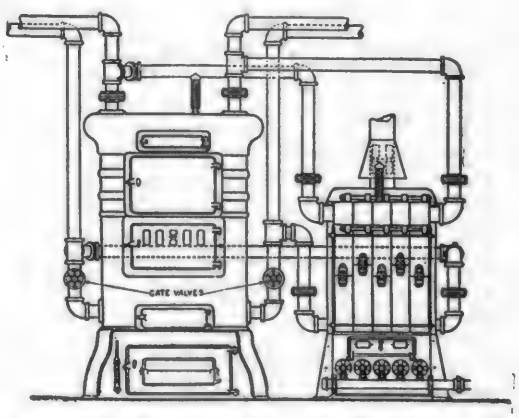
The gas company will handle the entire contract if so desired, paying the steam fitter upon completion and acceptance of the work, and will collect from the customer in twelve monthly installments.

The gas company will put the heater in on thirty days' trial and will remove the heater if unsatisfactory, allowing the customer the full value of the heater and thermostat. The purchaser in this case would pay only the steam fitter's installation costs.

The gas company will install a separate meter to be read daily during the trial period.

HOUSE HEATING WITH GAS IN BALTIMORE.

The report concludes with a report on the use of gas for house heating purposes in Baltimore. Baltimore now has a gas rate so low that it is entirely practical for its citizens to make use of this fuel at a very moderate cost. With the establishment of a secondary rate of 35 cents for 1,000 cu. ft. for excess domestic consumption, the industrial fuel department of the Consolidated Company began an extensive series of tests and investigations covering every phase of house heating. Houses were rented and used for experimental purposes with a



METHOD OF INSTALLING AUXILIARY GAS HEATER WHEN OWNER DESIRES TO RETAIN HIS COAL HEATER. EITHER ONE MAY BE USED INDEPENDENTLY OF THE OTHER.

view of establishing the cost of heating various types of houses with different heating systems. Various makes and designs of furnaces, radiators, burners and thermostats were tested in actual use and those best adapted for the purpose were selected and standardized for installation.

In the case of a house already provided with a coal furnace, there are three methods of procedure. The coal furnace may be removed and a gas furnace set in its place, a gas furnace may be placed beside the coal furnace and connected to the system so that either may be operated, or the coal furnace may be converted to the use of gas by installing suitable burners in it. The first two methods, it was pointed out, while representing a greater initial outlay, are also more efficient and satisfactory in operation. The company is advising its customers, whenever possible, to install a new furnace designed and built to burn gas, rather than to convert a coal furnace into a gas furnace.

Baltimore, it is stated, is the first city to have a rate low enough to make artificial gas available for heating homes at a moderate cost.

How to Fire a Furnace With Soft Coal.

Some timely points on the proper method of firing a furnace have been drawn up by the engineering extension department of the Iowa State College, and are given herewith:

In firing a furnace, remember that the main part of the air supply should come through and not over the fuel bed. Hence, do not leave the damper in the firing door open at all times.

Open it for a short time after a fresh charge is fired to burn gases. To leave it open after coal has burned to coke is wasteful.

Fire a fresh charge so it covers not only the whole fuel bed, but just the front of the furnace, thus leaving red coals at the rear uncovered so air may come through and help burn the gases.

Check the fire by opening the check damper in smoke pipe or by closing front damper or both and not by opening the furnace door or damper in door.

Shake regularly night and morning. In mild weather shaking once a day may be enough.

Keep the top of the fire level with the bottom of the firing door, or nearly so, at all times.

In cold weather the depth of the ashes beneath the fire should be less than in warm weather. In other words, vary the thickness of the fire with the weather, not by raising and lowering the top of the fire, but the bottom.

Remove ashes daily. Accumulated under the grates they spoil the draft and burn out the grates.

To fix the fire for the night, place the fresh charge on the fuel bed and allow to burn up with drafts open for a short time (not too long). Then close furnace for the night. In order to handle a furnace this way it must be tight.

COMPARATIVE EFFECTIVENESS OF DIFFERENT TYPES OF HEATERS.

House heating fuel tests, recently conducted by the engineering experiment station at Ames, present some interesting comparisons of various fuels and methods of heating.

For quick heat and fuel economy, the hot air furnace leads, although it may fail to distribute heat evenly in a house of more than one story. Hot water heat is economical, but slow to warm up a room, starting from a new fire; steam heat is fairly quick, but fuel cost is commonly high. It is suitable for a building of many rooms or under conditions which require steam in the radiators continuously.

Recent jumps in prices of certain fuels may, in some places, reverse the order of most economical fuels to buy. The following list, based on the tests made with a common type of steam furnace, does not attempt to fix fair prices, but gives approximate values per ton, compared with Iowa coals at $4 to $5:

Iowa lump coals	$4.00 to $5.00
Illinois lump coals	$5.00 to $6.00
Eastern soft coals	$5.50 to $7.50
Egg size hard coal	$6.25 to $7.25
Gas-house coal	$6.00 to $7.00

Domestic soft coals will yield a better actual heating value when more of the volatile gases are actually consumed. An underfed or down draft furnace or a very high furnace temperature may produce generally the desired result. A hot air furnace generally permits the highest, a hot water furnace the lowest fire box temperature.

THE HEATING AND VENTILATING MAGAZINE
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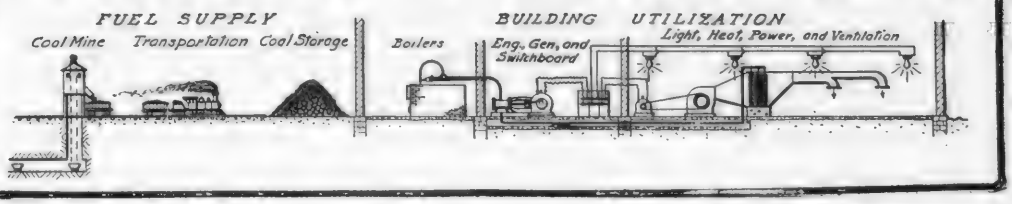
THE HEATING AND VENTILATING MAGAZINE takes pride in being enrolled among the three hundred trade journals, representing practically every industry in the country, that have pledged their services to the Government for any assistance they can render. Our bit will be done by giving publicity, both through our reading and advertising columns, to any measures which the Government desires to bring to public attention, and more particularly to the attention of engineers.

Speaking professionally, it is being asked what opportunities heating engineers will have for serving the Government. They will undoubtedly have many opportunities. With the adoption of the plan for raising an army of 2,000,000 men, the matter of barracks alone will involve a tremendous amount of work in connection with their mechanical equipment. Hospital buildings will also constitute an important item and inquiries have already been received as to the most practicable methods for heating temporary or portable hospital units. Then there is the equipping of additional industrial buildings and munition plants to turn out the vast supplies provided for in the stupendous $7,000,000,000 bond issue already authorized by Congress and which, it is stated, takes care only of the first year of preparation.

The trend of events has already gained such a momentum that military preparedness on an adequate scale is bound to become an accomplished fact, irrespective of the course of the war in Europe. America is awake and heating engineers, we are confident, will stand as a unit in helping the Government to vitalize at the earliest possible moment the incalculable resources and energy that are ours to command.

IN an effort to make THE HEATING AND VENTILATING MAGAZINE of wider usefulness to its readers and without departing in the least from its settled policy of confining its columns to matters of direct interest to the heating and ventilating profession, we are pleased to announce the inauguration of two new departments, one on "Air Cooling and Refrigeration" and the other on "Power Plant Equipment." It has been recognized for some time that the scope of the up-to-date heating engineer is extending more and more in these directions, but one difficulty has been to conduct such departments without infringing on the field already adequately covered by the refrigerating and power plant journals. This will be accomplished, in a large measure, by confining the new departments to matters of design and, further, to designs that have a close connection with the general heating and ventilation scheme. Readers are invited to submit problems or notes of interest in connection with air cooling, refrigerating or power plant work for discussion in these departments.

POWER PLANT ENGINEERING



Smaller Power Plants for Single and Group Buildings

The growing importance of ventilation, combined with more exacting requirements for artificial heating, has made it necessary for the heating and ventilating engineer to expand beyond the limits of his original field and to assume a larger responsibility. He must not only know how to use steam after it is generated, but he must also understand the problem of its generation and how most economically to procure the necessary power to operate his heating and ventilating fans, air washers, pumps, etc. As soon as such a step is admitted, he is immediately involved in power plant construction and also, to a greater or less extent, in electric current production.

In other words, the heating and ventilating engineer is being rapidly projected into the mechanical equipment field. And this is a logical development, because it is evident that as a rule the interests of a building are going to be much better served when its equipment is designed by one competent engineer and its apparatus co-ordinated throughout, than when the various parts are divided between the architect and three or four separate engineers whose work may at times conflict.

In recognition of this condition a new department, to be devoted to "Power Plant Engineering," with special reference to the smaller power plant, has been inaugurated this month in THE HEATING AND VENTILATING MAGAZINE. In general, the new department will deal with the points involved in the design of power plants for single and group building installations.

ENGINEER SHOULD BE JUDGE OF ADVISABILITY OF INDEPENDENT PLANT.

It is a generally recognized fact that the larger the power load of a building and the greater the number of hours per diem that this load (or the larger portion of it) is carried the greater will be the economy resulting from the installation of a power plant. It is not the province of the engineer to advocate a building plant under any and all conditions, however; on the contrary he must be the court to determine for the owner the advisability and saving possible, or the inadvisability and loss resulting, if a power plant should be installed. True, in many cases, these estimates must, to a large extent, be based more or less on supposed conditions. No man can say just how much power will be used in a building a year after its completion and still less what the consumption will be five years later. Yet by careful comparison with other buildings of similar type, close approximations can be, and are, derived.

BUILDING POWER PLANT A COMPLEX PROBLEM.

The building power plant presents for consideration a most complex question and even when convinced of its economy the first question asked is, "How much will it cost?" It has been argued by some that, where a heating plant *must* be installed in a building in any event, the power plant is only a side issue made necessary in order to secure the "by-product" of electric current. It is claimed that high-pressure steam in passing through an engine loses only 5% of its heat unit value and that in exchange for this 5% loss of heat the electric current is produced.

ARGUMENTS AGAINST THE INDEPENDENT PLANT.

Of course the arguments against power plants in buildings center around the initial investment and the upkeep. Combined with these there are usually four major arguments put up to the owner by the public service companies. These consist of the following:

(*a*) That the power plant cannot be built for the cost estimated.

(*b*) That the repairs and maintenance will be higher than supposed.

(*c*) That a cut in cost of electric current is probable in the near future.

(*d*) That some unexpected invention may be made any day which would make the apparatus in the power plant obsolete, resulting in a dead loss to the owner.

The owner, who lacks the technical knowledge to discriminate between reasonable and unreasonable statements along this line, is not capable of giving such claims a correct appraisal. For this reason the engineer must not only be prepared to prove his own case from an engineering standpoint, but must also stand ready to argue its merits from a non-technical and purely practical standpoint.

There can be no doubt that the elimination of a power plant from any building is—in certain respects—very desirable. For instance, coal and ash-handling dirt can be avoided, a stack can be eliminated, space in the basement—more or les valuable for storage—is made utilizable, etc. But if a *heating* plant *must* be installed this feature loses its force for, with a heating plant, the coal and ash nuisance must be endured, a stack will have to be built and considerable space surrendered in the basement for boilers and other heating equipment.

As a general thing the following may be set down as constituting items favorable or detrimental for the installation of a power plant in a given building.

CONDITIONS THAT DETERMINE ADVISABILITY OF ISOLATED PLANT.

Favorable

Long hours of occupancy
Heavy light and power demands
Large building
Separate heating plant necessary
Skilled attendance
High electric service rates
Low cost of coal

Unfavorable

Short hours of occupancy
Small light and power demand
Small building
District heating available
Non-skilled attendance
Low electric service rates
High cost of coal

To make a fair comparison between a plant or no plant, two operating estimates must be made—one assuming power, heat and light produced on the premises and the other assuming one, two, or all to be purchased from service companies at their regular or best-quoted rates. In order to secure legitimate and comparable results the same amount of service should be used while computing on each basis, and it is here that the designer must use his judgment. Conditions are frequently found where the assumption of a large load would show an economy for the plant, when a smaller loading would result in a saving by using street service.

It is manifestly unfair to assume abnormal conditions on either side of the question and averages from other similar buildings should determine the quantities decided upon.

Another feature is the cost of breakdown service made by the public service companies which is a necessary adjunct to a *cheap* building power plant. To make the power plant sufficiently trustworthy so that this breakdown service may be omitted will require duplicate apparatus and an increased investment.

SUITABILITY OF OUTSIDE ELECTRIC CURRENT AN IMPORTANT FEATURE.

The suitability of the outside electric current for the uses in the building also has a most important bearing on the matter. Oftentimes certain apparatus to be installed requires a current of a given description. For example, electro-plating requires a direct current of low voltage and no other current will do. Again laboratories may require alternating curent of a given phase and cycle. Where current is purchased from an outside company it quite likely will not correspond to that best suited to the needs of the building and, therefore, will require some modification before being most satisfactory for use.

This may involve a rotary-converter, or motor generator, transformer, etc., all of which must be charged to the cost of outside current in order to arrive at a true comparison.

Advantages on the other side may also occur with high pressure steam available in the building. Its current consumption can be then cut down by using steam-driven vacuum pumps, high-pressure lift traps, and engine-operated fans.

In succeeding issues the new department of "Power Plant Engineering" will take up, in a simple, straight-forward way, the various apparatus used for small power-plant work, with a discussion of its uses, allowable capacities and other features that now come within the scope of the heating and ventilating engineer.

Notes

A bulletin (No. 119) on "The Analysis of Coals" has been issued by the Bureau of Mines. This bulletin contains complete data on various grades and sizes of coal obtained throughout the U. S. and also covers many foreign coals. One of the most interesting features is the price per ton paid by the various government buildings throughout the country from 1908 to 1915. The entire matter covered in the pamphlet, which contains over 100 pages, is carefully indexed and prepared for ready reference.

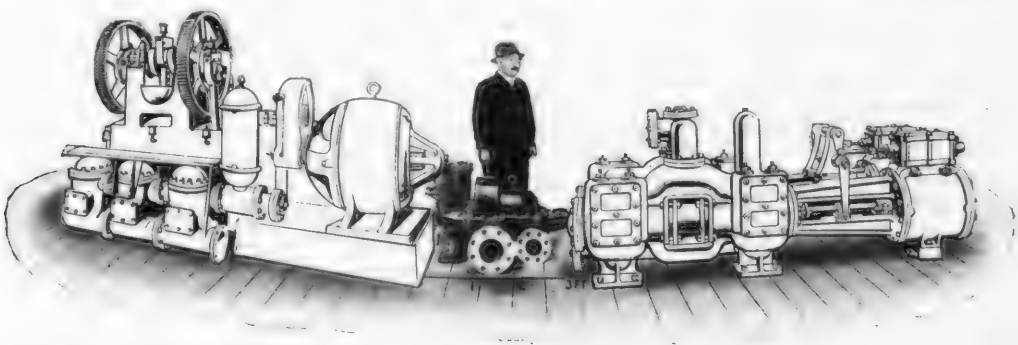
* * *

To meet the increasing demand for centrifugal boiler feed pumps the DeLaval centrifugal boiler feed pump coupled to an independent steam turbine has been designed. The matter of space conditions has also been considered by the manufacturers who have produced a unit taking less space than other pumps of similar capacity of the duplex steam type, or the triplex motor-driven type, the duplex pump weighing about five times as much and occupying eight times the floor space. Comparative views of the three types of pumps showing the relative sizes are shown.

To provide against any possibility of racing the unit is equipped with an emergency governor. This consists of a pin contained within a hole bored diametrically through the shaft. The pin is held by a spring from flying out under the influence of centrifugal force. When the speed reaches a certain point, the spring is compressed so that the pin strikes a trip, releasing another spring by which the governor valve is closed at once and completely. Racing and excessive over pressure are therefore impossible. The normal speeds of these pumps vary from 1,800 to 3,500 r.p.m., according to pressure and capacity, and due to the heavy shafts employed are far below the critical speeds.

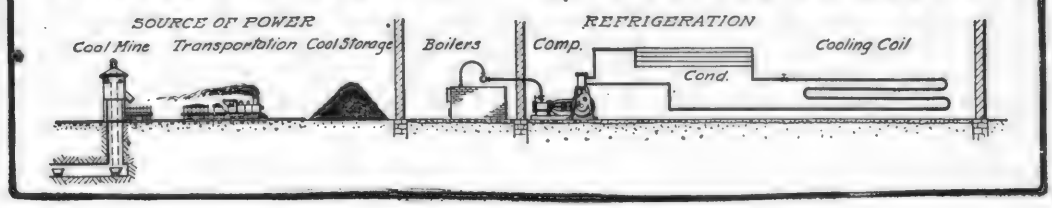
* * *

Minneapolis, Minn.—According to the *Minneapolis Tribune,* the public utility companies of the United States have just experienced the most prosperous year in their history. The great activity in steel, copper and other industrial lines, partly due to the European War and partly to the general prosperity of the country, naturally called for a large increase in the consumption of motive power to carry on this enormous business. The light, heat and power companies reported record-breaking earnings. It is pointed out, however, that the great increase in the earning power of the public service corporations did not go into the reserve account of the companies, as would generally be expected. The cost of materials necessary in the manufacture of power and light increased very rapidly during the past year. This caused serious inroads in the net earnings of the various properties. The total output of electricity of the central power stations of the United States during the year 1916 was 23,300,000,000 kilowatt hours, the largest in the history of the industry, and an increase of 22.5 per cent over the year 1915. The total was double that of 1912, the year of the last census. The gross earnings of such companies amounted to $520,000,000, as compared with $302,115,000 in 1912, or an increase of approximately 72 per cent. Expenses increased from $234,419,000 in 1912 to a total of $424,000,000 last year, or an increase of about 80 per cent. The number of persons employed in this branch alone amounted to 94,000 in 1916, against 79,000 in 1912. It is estimated that at present fully 5 per cent of the population of the United States derive their livelihood from the electrical industry.



DE LAVAL STEAM-TURBINE DRIVEN BOILER FEEDER COMPARED WITH DUPLEX STEAM PUMP AND TRIPLEX MOTOR-DRIVEN PUMP, ALL OF SAME CAPACITY.

AIR COOLING AND REFRIGERATION



Notes on Air Cooling Practice

The science of heating is only imperfectly completed unless it is also combined with the art of air cooling. In fact, it is entirely true that a human being suffers more from the extreme of heat than from the extreme of cold.

This being so, the question suggests itself as to why the science of heating has been accorded so much more importance than the subject of cooling. In reality this is caused simply by the consideration of freezing. If a building has its temperature fall below 32° F., every water pipe in the entire structure is in danger of freezing and bursting, resulting in damage from water. Thus, long before the thermometer gets to the point where the cold becomes a real bodily discomfort, other considerations render the supplying of artificial heat imperative.

How long will it be before the demands of physical comfort will insist that a building not only must not go below 70° F. in winter but also that it must not go *over* 70° in summer? Many of the manufacturers of the country, notably those engaged in work connected with the paper industry, have found temperature and humidity control an absolute essential to good work; This means that the buildings must be cooled in summer as well as being heated in the winter. Some buildings are operating artificial cooling systems purely for comfort, and if cooling could be accomplished through a comon steam radiator as simply as heating is carried out, many additional buildings would utilize this desirable feature.

Artificial cooling, however, cannot be accomplished with the same facility as artificial heating; the apparatus is more complex and the means of cooling confined within certain rather restricted limits. What might be termed "direct cooling" (corresponding to "direct" heating) is not practical in occupied rooms owing to the accumulation of moisture which freezes into ice on the cooling surface, a familiar example of this being the exposed pipes in a refrigeration box which are often entirely obscured from sight by the "frosting" of the outside.

Successful cooling of occupied rooms can hardly be carried out practically by any other means than that of the "indirect" system. In this method the air is moved by a fan and is cooled by the evaporation from a water spray or by being drawn across a cooling surface on which the collection of ice does not matter.

EFFECTIVENESS OF AIR WASHERS.

For cooling economically the common air washer is most satisfactory but the temperature range is rather limited unless cold well water in large quantities is obtainable at low cost. Where well water is not obtainable the water used in the washer may be cooled by artificial refrigeration or brine coils may be used in a manner similar to the steam coils installed for heating.

It must be remembered that artificial cooling should not be carried on at present with too lavish a hand, for the cooled building is going to be the exception rather than the rule for some time to come. It is human to judge by comparison and the entrance into an over-cooled building from the glaring heat of the street may, in extreme temperatures, produce too much of a change for comfort. Some buildings vary the temperature from day to day, maintaining a higher temperature within when the outside temperature climbs up so as to produce less of a contrast of entering from the outer air.

DIRECT EXPANSION AND ABSORPTION METHODS OF COOLING.

Where artificial refrigeration is to be

installed in a building, either entirely for the purpose of summer cooling, or to meet other requirements with the building cooling only as a side issue, there are two methods which may be used—the "direct expansion," which is the simplest—and the "absorption" method which is more complicated but gives a little better control. These methods are simply two means of accomplishing the same end, just as a steam system or a hot water system will each heat a building equally well when properly designed.

One thing that should always be borne in mind in dealing with refrigeration systems and that is "Care." The refrigerating engineer who has *successfully* operated plants is invariably a *careful* engineer and one who looks after the details of the system, the small leaks, the condition of his valves, the temperatures and pressures recorded, etc., with great exactness. Little matters which might be safely neglected for awhile in a power plant should receive instant attention in a refrigeration plant to avoid their becoming a positive menace.

For this reason the runs of piping, location of valves, and general arrangement of the plant to facilitate inspection and quick control are most vital. Access to all parts should be carefully arranged and blind alleys and pits avoided as far as possible. All piping should be freely exposed to view and the apparatus gauges, and recording instruments placed in conspicuous and well-lighted positions.

While there are several mediums which may be used in the production of artificial refrigeration such as air, carbon dioxide, and sulphur dioxide; the most suitable as well as the most commonly used is ammonia gas. Therefore, a consideration of refrigeration is to a large extent a study of ammonia and its properties. Anhydrous ammonia is liquified ammonia which results from the compression of ammonia gas at high pressures and contains no water; it should not be confused with aqua ammonia which is only a solution of ammonia gas and water.

Anhydrous ammonia boils at about 28° below zero Fahr. and a pound of liquid ammonia when expanded into ammonia gas at atmospheric pressure occupies about 21 cu. ft., this expansion and vaporization requiring some 555 B.T.U. in the process. Liquid ammonia is colorless and weighs about 42 lbs. per cubic foot being only about two-thirds as heavy as water. Commercial ammonia is obtainable in a very pure condition, the impurities seldom running over ½ of 1%, and often as low as 1/10 of 1%. If the impurities (which gradually accumulate in a system) reach 2% they become detrimental as they interfere with the action of the gas.

PROPERTIES OF AMMONIA.

The following table illustrates some of the more interesting properties of ammonia at various temperatures:

Refrigeration is calculated by the B.T.U. method, largely in the same manner as in heating work, except that the process is reversed. All the losses are based on heat transmission taken in B.T.U. and the unit of plant capacity is "tons" of ice, (equivalent to horsepower of a heating system), one ton capacity consisting of absorbing sufficient heat to melt one ton of ice or 2,000 lbs. × 142 B.T.U. = 284,000 B.T.U. In rating an apparatus the "tons" used is the tons per twenty-four hours and not tons per hour.

Temperature Degrees F.	Gauge Pressure Lbs. Per Sq. In.	Latent Heat B.T.U.	Volume of 1 lb. of Gas, Cu. Ft.
—25°	1.47	570.68	16.44
—20	3.75	567.67	14.48
—15	6.29	564.64	12.81
—10	9.07	561.61	11.36
— 5	12.87	558.56	9.89
0	15.67	555.50	9.14
5	19.47	552.43	8.04
10	23.85	549.35	7.20
15	28.24	546.26	6.46
20	33.25	543.15	5.82
30	44.72	536.92	4.73
70	114.49	511.52	2.24
100	200.42	491.5	1.36

Notes

The following cities have artificial ice rinks—New York, Chicago, Cleveland, Boston, Montreal, Quebec, Toronto, Hamilton, Vancouver, Portland, Oregon and San

Francisco. Several of these were built last year and other cities will fall in line this year.

* * *

An ice plant is not rated by its hourly capacity but on the basis of 24 hours, so that to obtain the capacity of a refrigerating plant the heat absorption per hour must be multiplied by 24 in order to correctly get the plant rating. With a heating plant the heat supplied per day must be divided by 24 in order to get the plant capacity and horsepower—an important difference between the method of ratings.

* * *

Compressed air is used for refrigeration on ship board and in other places where stray ammonia fumes would be particularly objectionable.

* * *

The distribution of brine over the floor in an artificial ice rink is one of the most difficult problems of refrigeration. Unless the flow is even and equal over the entire surface soft spots will develop resulting in the whole surface being spoiled. One method of overcoming this consists of the employment of two supply headers, one at each end of the rink and the supplying of the pipes on the floor alternately so that the brine in one pipe is flowing in one direction and the brine in the two adjacent pipes in the opposite direction. At the return ends of each line headers are placed and the return brine is picked up in a manner similar to that used in the supply lines; this is illustrated in Fig. 1. In order to make assurance doubly sure each pipe is valved at the supply and return header so that the flow in every line can be controlled absolutely.

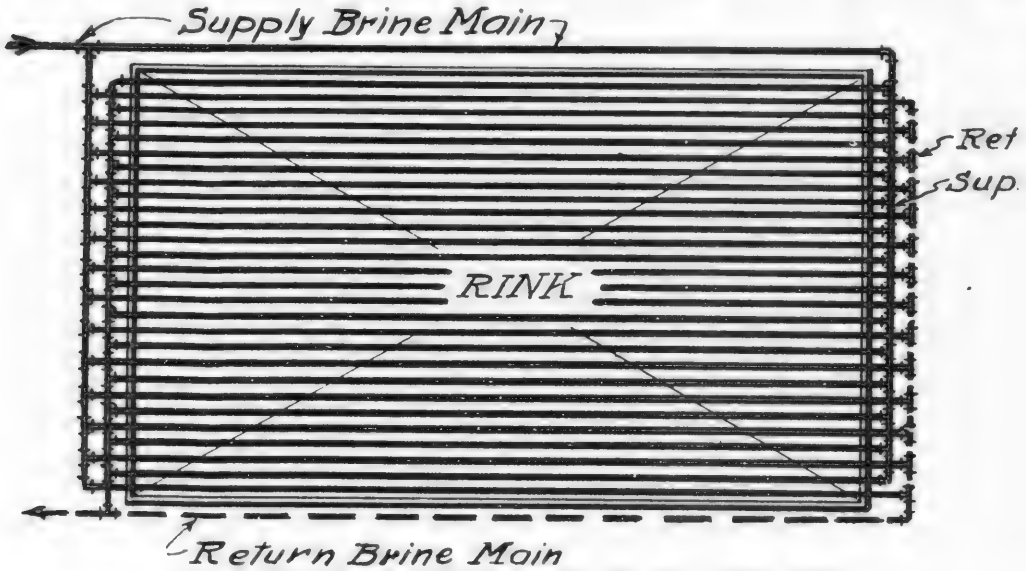


FIG 1.—ARRANGEMENT OF BRINE PIPING FOR ICE SKATING RINK.

Proposed Boiler Rules of the New York State Industrial Commission.

A volume of proposed rules for the construction, installation, inspection and maintenance of steam boilers has been compiled by the New York State Industrial Commission and public hearings were arranged to be held in various cities throughout the State during April. The proposed code, with index, takes up 129 pages. Part 1, Section 1 is devoted to new installations of power boilers, occupying 80 pages. Part 1, Section 2 is devoted to new installations of "boilers used exclusively for low pressure steam and hot water heating and hot water supply." The maximum allowable working pressure for low pressure steam heating boilers is given as 15 lbs. per square inch. Part 2, Section 2 refers to existing installations. This is followed by an appendix, covering efficiency of joints, braced and stayed surfaces, safety valves and fusible plugs.

Court Decisions on Workmen's Compensation Law.

Court decisions in New York State on the workmen's compensation law, covering the period from July 1, 1914 to August 1, 1916, have been issued as a special bulletin by the New York State Department of Labor. This covers the entire period that the law has been in effect. The volume, which contains 406 pages, has a subject index, and also a complete list of cases.

Standard Methods of Testing Discussed by British Heating Engineers

A New Unit Proposed to Express Boiler and Radiator Capacity, to Be Known As a "Centitherm."

One of the principal items on the programme of the annual meeting of the Institution of Heating and Ventilating Engineers, held in London, England, February 13, was a paper on "Standard Methods of Testing," by A. H. Barker. The principal points in this paper are given in the following summary, made by *The Plumber and Journal of Heating* (London):

The author said he would like again to consider the desirability and the possibility of adopting standard methods of testing heating and ventilating plants.

The object of laying down standard methods of testing is that it might be possible to gauge the success of a design on sound principles and to eliminate automatically all the factors which hid the true results. If such tests were properly carried out it would be impossible for a bad apparatus to masquerade as a well-designed one, and attention would be automatically called to the parts of the design which were wrong. A bad test did none of those things.

Thus, the ordinary method of testing a heating apparatus by measuring the temperatures produced in rooms, especially in variable conditions of the outside weather, is of no value whatever for giving exact information about the apparatus or to serve as a guide in the design of future apparatus. Such a test, however, if it could be so called, might conceivably satisfy a client, and it might also satisfy an engineer that the apparatus was not liely to be any more trouble to him.

It would be absurd to deny that these were two very important things from the present commercial point of view. All faults of design are automatically buried if the apparatus is once made to work to the satisfaction of the client, even if that satisfaction is based on the client's ignorance of the defects. That is the only real ground on which the present system can be defended.

At the same time one should not shut his eyes to the fact that such tests are of no scientific value whatever, and of no technical value to the engineer. They do not even prove that his apparatus is well designed, nor show him how he can do better in the future, nor in what way he might produce an equally satisfactory result with half the expenditure of money; nor that the client could not get an apparatus, which would satisfy him equally well, for an expenditure of fuel of 60 per cent of what he has actually to spend, nor does it give the engineer any information of any kind of future value.

WOULD TEST VARIOUS PARTS OF SYSTEM INDEPENDENTLY.

The author proceeded to consider the testing of details, prior to taking the plant as a whole.

The first portion of the apparatus that claims attention is the boiler, and of all firms is expensive to erect and difficult to test satisfactorily.

A testing plant such as formed part of the equipment of our larger boiler-making firms is expensive to erect and difficult to work. It is designed for the purpose of rapidly and thoroughly testing every feature of one boiler after another.

Describing the bare minimum of apparatus required for making a satisfactory boiler test, such as could in favorable circumstances be erected by an engineer in his own yard, the author said for such a purpose it is of no use testing a boiler on two separate occasions without securing uniformity in (1) quality of fuel; (2) rate of fuel consumption; (3) the flow and return temperatures at which the boiler is working. But if these factors can be kept standard and constant then there is no reason why a perfectly uniform result cannot be secured time after time, and much valuable information arise therefrom.

TEST OF FUEL.

The first of these questions, namely, the burning quality of the fuel, is a great difficulty. Mr. Barker said he did not know of any test which would determine the burning quality of the fuel in such a way that different fuels could be used for testing purposes. To get over this difficulty it would be necessary to fix arbitrarily on a certain type of fuel for testing purposes only.

All real anthracites burn in pretty much the same way, and it might be remarked that there is a great deal of coal sold (in

England) as anthracite, which is in reality not anthracite at all. Hence, if a real anthracite were used for the purpose, a careful test of its calorific value would be sufficient. This test could be best made with a bomb calorimeter, but this instrument is expensive and requires a god deal of skill to use. A much cheaper method and one very satisfactory to use was illustrated by the author as follows:

A glass jar, perhaps 20 in. long × 4½ in. diameter, has fixed inside it an ordinary lamp glass with a stopper at the top through which a glass pipe passes. A small perforated copper thimble is provided to hold about 2 grams of powdered fuel, which is carefully collected from the bulk to make sure that a representative sample has been taken.

A small cylinder of oxygen is employed to force and keep the lamp glass full of the oxygen. The fuel is ignited by a spark, and the oxygen causes the fuel to burn rapidly and force the heated product of combustion out into the water.

The weight and temperatures of the water are observed, and several carefully selected and weighed samples of the fuel burnt in this manner, and the calorific value of the fuel thus determined by the rise of temperature in the water. Such a test as this is a necessary preliminary to any satisfactory boiler test.

TEST OF BOILER.

Although, as had been said, such tests can only be easily made on a plant already fixed up for testing purposes, it might be well to explain how they could conceivably be made in an engineer's own yard, with the necessary precautions to ensure uniformity.

Constancy of temperature may be secured by fixing a large tank containing perhaps 2,000 gal. of water, kept constantly at 130° F., a few inches above the level of the top of the boiler, and connecting a pipe from the tank so as to cause the water to flow into the boiler return, and provided with a valve that the flow could be regulated to such a value that the outflow temperature was constantly 160°.

The water, after passing through the boiler, may be cooled again to 130° by exposure to the air by running over a large surface of corrugated iron and allowed to fall into a tank, from which it is again pumped up to the upper tank, its temperature being first reduced to 130° by the addition of cold water or otherwise.

If a large chimney were not available it would be necessary to apply artificial draft to the boiler by means of an induced draft fan, drawing from the boiler outlet and discharging into the open air. The fan could readily be arranged to maintain the required difference of pressure between the firegrate and the outlet, for it is on this that the rate of combustion of the fuel depends.

The method whereby the rate of combustion can be measured is a very great difficulty. The only really satisfactory method is to fix the entire boiler on the platform of a weighing-machine, and take its weight, fuel and all, at the end of every ten minute interval. This involves, of course, making mercury seal connections to the boilers, so that its apparent weight is not influenced by stresses in the connection pipes, and this is necessarily a very expensive proposition. As it is impracticable in a scratch test, the only way is to arrange for a long test of not less than ten hours' duration after the fire is burning a full power, weigh in the standard fuel, and burn it at such a rate as to maintain the temperature desired, the water supply being kept accurately constant at an appropriate value.

The author suggested also that the power of a boiler should be given in units, which might be called "centitherms," or 100 therms, or British thermal units, per hour, and that the same unit be adopted throughout the trade for all purposes.

RADIATOR TESTS.

To calculate correctlv the emission from a radiator from correct sets of tables determined from acurate experiments, with different co-efficients for each individual height and design and for different temperatures, would throw an enormous amount of work on the person making the calculations. In fact, hardly one person in a hundred ever attempts such calculations.

What is really required for practical purposes is not the heating surface of the radiator and not the variable co-efficients of emission, but the *total emission* of each size of radiator under certain standard conditions as to location and temperature. Then there would be no need for any calculations at all. Nobody cares what the surface of the radiator may be so long as it gives off the desired amount of heat. Provided always the radiator temperatures are kept up to the standard, the amount of heat calculated on can be arrived at.

The actual conditions which will secure a constant emission from any radiator are: (1) Still air at a given surrounding air

temperature; (2) a given flow and return water temperature, secured by employing a constant flow of water at a given temperature through the radiator; (3) a flat surface of given emissivity, maintained at a constant given temperature at a given distance from the radiator under test. Unless all these conditions could be simultaneously fulfilled it is impossible to obtain uniformity of result from any test.

PROPOSED STANDARD METHOD OF TESTING RADIATORS.

In order to attain this ideal there should be a standard method of testing radiators, which should be somewhat as follows:

Assuming the standard flow and return temperatures to be respectively 160° and 130° F., the radiator should be fixed up on the testing stand 2 in. in front of a large, flat, blackened surface, maintained at a constant temperature of 90°. Water should be allowed to flow through the radiator with top and bottom connections from a large tank maintained at 160°. The flow of water should be increased by a valve, automatically operated or otherwise, until the return temperature was settled at 130°, and the quantity of water required to produce this result flowing from the radiator per hour (w) carefully weighed, and the heat emission in these conditions calculated by the formula $w \times 30$. This figure divided by 100 should be the nominal power of the radiator. Such a surface as would give off 100 therms per hour would be a nominal radiator unit, and the author suggested should be called a "centitherm." This expression would then be used instead of the present "square foot" for all purposes connected with emissions from heating apparatus. Catalogues would then give the number of "centitherms" which a radiator would give off if maintained at standard temperatures.

FRICTION IN PIPES

Great discrepancy exists between the resistance per unit length of different samples of pipes nominally of the same size.

It is at least as important to the heating engineer to know what is the resistance of his pipes as it is to the electrical engineer to know the resistance in ohms per mile of the cable he uses.

The accurate testing of pipes is as complicated and difficult a matter as the testing of boilers and radiators, but it should be possible to erect quite a simple standard testing plant which any heating engineer could use in his own yard, and which would show him the degree of uniformity of the pipe he was buying.

The simplest standard method of testing the uniformity of pipes that the author could devise is as follows:

Two large testing tanks are provided, say 15 ft. apart, and fixed at different levels, one being 12 in. below the other. Means are provided for keeping the level of water in these tanks accurately constant throughout the test.

The method proposed for doing this was the same as adopted in the laboratory for pipe and radiator tests; namely, to provide a large standing overflow-pipe in each tank and allow the water to pass into it at such a rate that the tank just overflowed and no more. Any individual length of pipe could be tested by allowing water to flow from the upper of these two tanks into the lower through the pipe under test, and measuring carefully, by weighing or otherwise, the amount of water which would flow in five minutes under this constant head.

COMPLETE APPARATUS.

Turning briefly to the testing of a complete apparatus, the author said if a heating apparatus was perfectly designed it would fulfill some such conditions as the following with all valves wide open:

1. Supposing the temperature in the flow-pipe near the boiler to be maintained constantly at 160°, then the temperature at the entrance to each radiator should not be less than 155°, and should be almost the same for every radiator in the installation. This was very easy to attain except in very long installations.

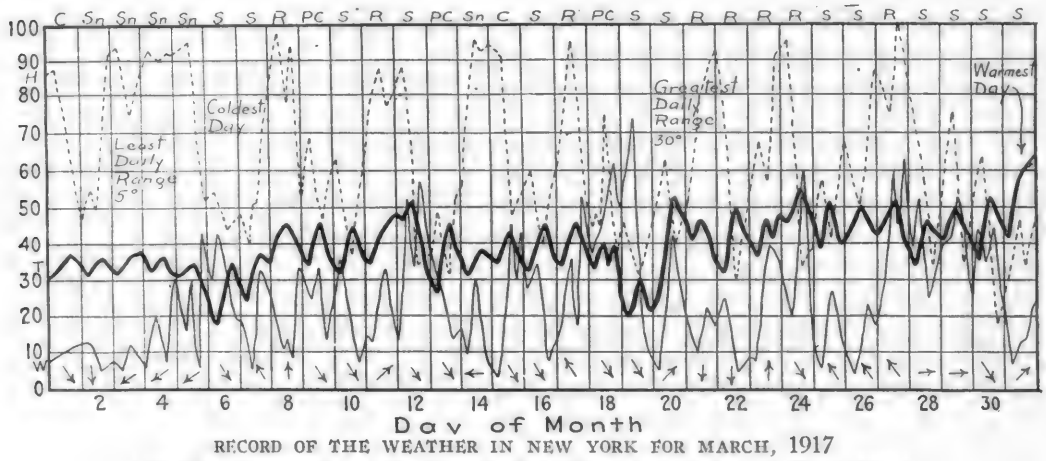
2. The temperature of the return-pipe from each radiator should also be the same within 5°; that is, it should in no case be below 125°, and in no case above 130°. That was as near as could be got in the present state of tube manufacture. It could only be attained by careful and correct design.

3. The total amount of fuel burnt after the apparatus had attained the above-named temperatures during the next ten hours should not exceed $\frac{H}{8}$ lbs. for every ten hours it continued working, when H is the total heat given to the rooms per hour in "centitherms." This condition depended on the efficiency of the boiler and of the coating employed.

The fire-pot should be filled once at the beginning of the test, once after a period of 3 hours 20 minutes, and once after the expiration of 6 hours 40 minutes, the fires being properly cleaned on each occasion.

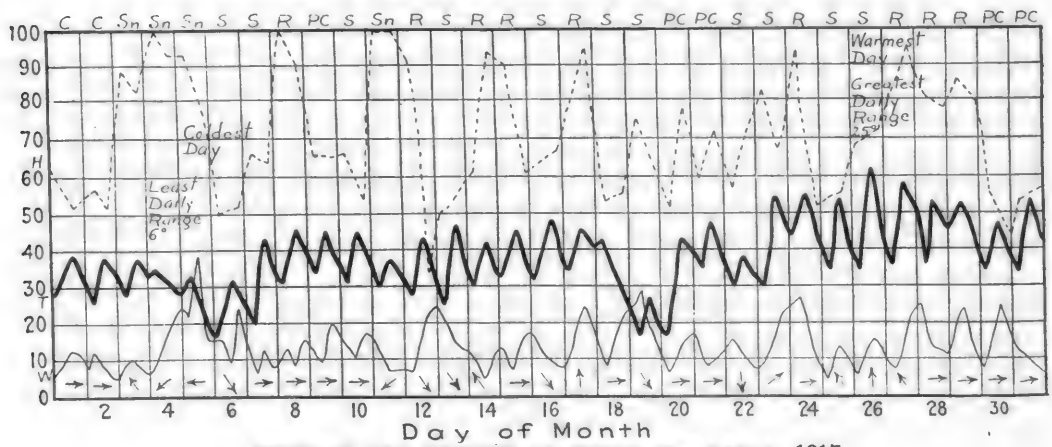
The Weather for March, 1917

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	64	61	73	76	80
Date of highest temperature	31	26	31	31	31
Lowest temperature, degrees F.	18	17	12	11	14
Date of lowest temperature	6	5	6	5	4
Greatest daily range, degrees F.	30	25	34	31	31
Date of greatest daily range	20	26	7	31	26
Least daily range, degrees F.	5	6	6	5	6
Date of least daily range	3	4	4	12	2
Normal temp. for month, deg. F.	39	37	41	38.8	46.6
Normal mean temp. for month, deg. F.	38	35	39.5	34.4	43.5
Total rainfall, in.	3.38	3.73	3.36	2.1	1.8
Total snowfall, in.	11.4	12.9	13.1	2.11	0.3
Normal precipitation, this month, in.	4.10	4.08	3.01	2.55	3.43
Total wind movement, miles	15,444	9,265	11,389	11,921	14,241
Prevailing direction of wind	N. W.	W.	W.	W.	S.
Average hourly wind velocity, miles	20.8	12.5	15.3	16	19.1
Number of clear days	9	12	8	7	10
Number of partly cloudy days	7	10	10	12	11
Number of cloudy days	15	9	13	12	10
Number of days on which rain fell	8	9	11	4	12
Number of days on which snow fell	5	4	3	5	..
Snow on ground at end of month, in.	..	..	..	..	..

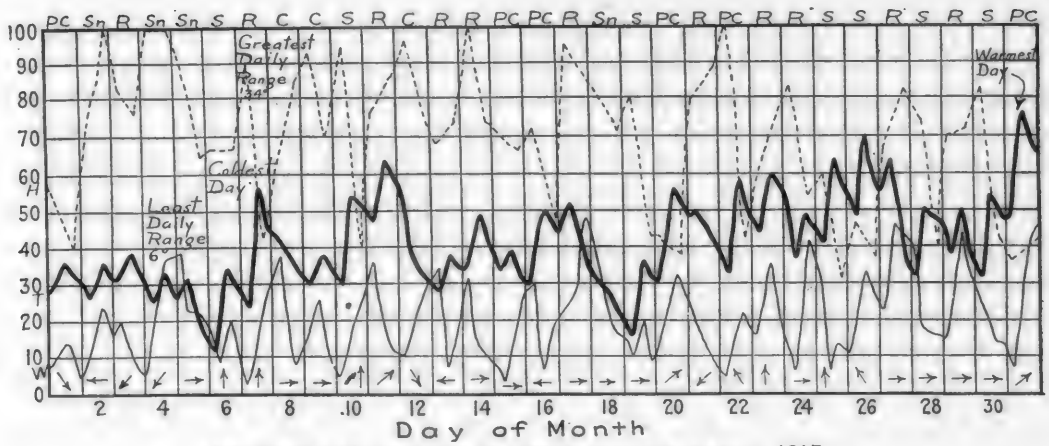


RECORD OF THE WEATHER IN NEW YORK FOR MARCH, 1917

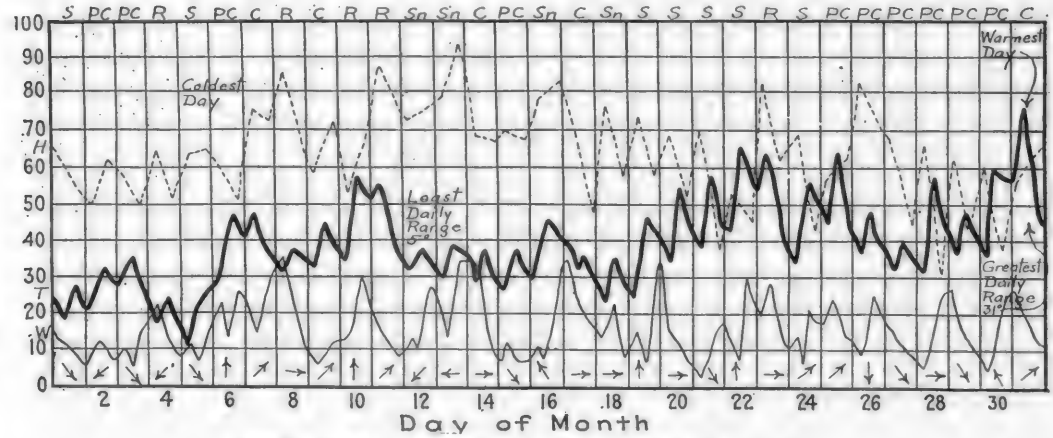
(Hourly Observations of the Relative Humidity Are Recorded on This Chart.)



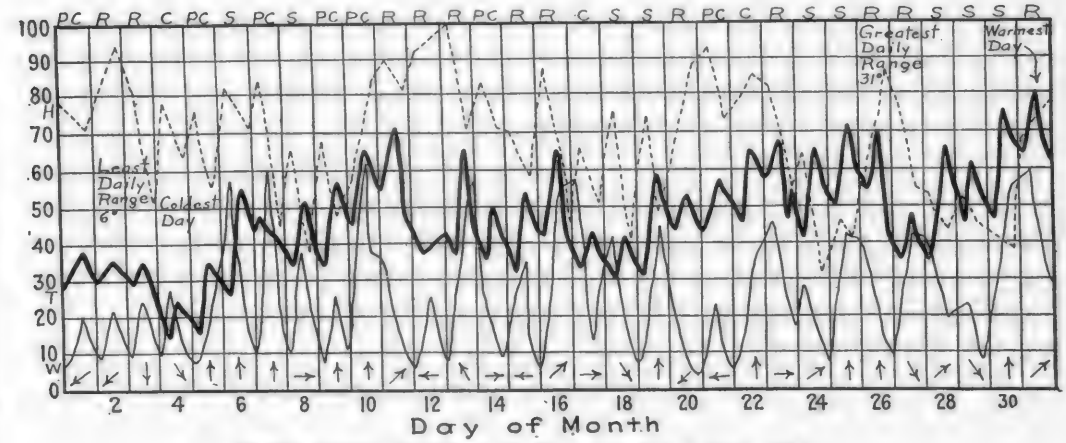
RECORD OF THE WEATHER IN BOSTON FOR MARCH, 1917



RECORD OF THE WEATHER IN PITTSBURGH FOR MARCH, 1917



RECORD OF THE WEATHER IN CHICAGO FOR MARCH, 1917



RECORD OF THE WEATHER IN ST. LOUIS FOR MARCH, 1917

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn.—snow.

Arrows fly with prevailing direction of wind.

NATIONAL DISTRICT HEATING ASSOCIATION

Programme for Ninth Annual Convention.

Following is the revised programme for the ninth annual convention of the National District Heating Association, which will be held at the Pontchartrain Hotel, Detroit, Mich., June 12-15.

FIRST SESSION, TUESDAY MORNING, JUNE 12.

Address of welcome.
Response, George W. Martin, New York.
Report of executive committee.
Election of new members.
President's address.
Report of secretary-treasurer.
Appointment of nominating committee.
Report of constitutional revision committee.

SECOND SESSION, TUESDAY AFTERNOON, JUNE 12.

Address by Professor John R. Allen, University of Michigan.
Report of station operating committee by J. G. DeRemer, chairman, New York.

THIRD SESSION, WEDNESDAY MORNING, JUNE 13.

Paper by Nelson S. Thompson, Washington, D. C.
Address: "A Study of District Heating in the Central West," by Professor J. D. Hoffman, University of Nebraska.
Report of underground construction committee, by H. A. Austin, chairman, New York.

FOURTH SESSION, WEDNESDAY AFTERNOON, JUNE 13.

Report of public policy committee, by S. Morgan Bushnell, chairman, Chicago.
Report of educational committee, by George W. Martin, Chairman, New York.

FIFTH SESSION, THURSDAY MORNING, JUNE 14.

Discussion of report of research committee.
Report of accounting committee, by C. A. Gillham, chairman, New York.

SIXTH SESSION, THURSDAY AFTERNOON, JUNE 14.

Address on "Rates," by Halfred Erickson, Chicago.
General discussion on rates.
Report of nominating committee.

SEVENTH SESSION, FRIDAY MORNING, JUNE 15.

Report of meter committee, by Fred B. Orr, chairman, Chicago.
Report of record committee.
Election of officers.
Discussion session. Subjects as follows:
Value of associations and their work, opened by D. L. Gaskill.
Underground crossings, opened by H. R. Wetherell.
Heat losses from mains under various conditions, opened by R. C. March.
Ash and coal-handling problems, opened by J. L. Hecht and J. C. Martin.
Temperature regulation, opened by H. R. Wetherell.
Customers' piping in relation to district heating, opened by J. C. Hauser.

ENTERTAINMENT.

The annual banquet of the association will be held at the Hotel Ponchartrain Wednesday evening, June 13. Outings for the ladies will include an automobile ride on Thursday afternoon, June 14, terminating at the Detroit Boat Club, on Belle Isle. The same evening there will be a theatre party for all.

On Friday afternoon, June 15, the entire party will go on a boat ride up the Detroit River to St. Clair Flats.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Chicago Chosen for 1917 Convention.

The twenty-ninth annual convention of the National Association of Master Steam and Hot Water Fitters will be held in Chicago, Ill. The dates chosen are June 11-15, Monday to Friday, inclusive. Headquarters will be at the Hotel Sherman.

Master Steam Fitters' Association in New Quarters.

New headquarters for the National Association of Master Steam and Hot Water Fitters have been taken at 50 Union Square, New York, Seventeenth Street and Fourth Avenue. The new quarters are on the ninth floor of the Germania Life Building. The offices of the association have been located, for the past twenty years, in the Wool Exchange Building, 260 West Broadway, New York.

Wisconsin State Association.

Officers were elected as follows at the seventh annual convention of the Master Steam and Hot Water Fitters' Association

of Wisconsin: President, Frank H. Meadows, Milwaukee; vice-president, James B. Sullivan, Stevens Point; secretary and treasurer, Fred Kaufman, Milwaukee; recording secretary, Albert W. Luebke, Milwaukee; sergeant-at-arms, M. Mueller; Milwaukee. Board of directors: Edmund Grassler, Milwaukee; E. J. Sullivan, Kenosha; Albert W. Luebke, Milwaukee; and Frank Downey, Milwaukee.

New York City Association.

New officers were elected at the annual meeting of the New York Master Steam and Hot Water Fitters' Association, held March 27: President, William H. Curtin; vice-president, J. E. Rutzler; treasurer, J. T. Dyas; secretary, Henry B. Gombers. Board of directors: William H. Curtin, J. E. Rutzler, J. T. Dyas, Charles G. Witherspoon and Charles Schneider. The board elected William H. Curtin chairman, and J. E. Rutzler, vice-chairman.

Newark (N. J.) Association.

Newly-elected officers of the Master Steam and Hot Water Fitters' Association of Newark, N. J., are as follows: President, John H. Nelles; vice-president, John G. Keller; treasurer, T. B. Cryer; secretary, Harry Geiser. George W. Dennis was elected a member of the executive committee.

Washington (D. C.) Association.

Officers elected at the annual meeting of the Master Steam and Hot Water Fitters' Association of the District of Columbia, are as follows: President, I. A. Slyder; vice-president, D. D. Condon; secretary and treasurer, Thomas Egan.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

New York Chapter Elects Officers.

New officers were elected as follows at the April meeting of the New York Chapter, held at the Building Trades Club, April 16: President, Frank K. Chew; vice-president, C. E. Pearce; secretary, C. W. Obert; treasurer, William J. Olvany. Board of governors: Arthur Ritter, P. H. Seward and H. G. Isertell. The installation ceremonies will take place at the May meeting.

The retiring president, Arthur Ritter, announced that the board of governors had passed a resolution pledging the loyalty and services of the chapter to the government in connection with the war, the announcement being greeted with applause.

After the routine business was transacted, the meeting was turned over to M. W. Franklin, the chairman of the evening, who carried out the sentiments of the occasion by wielding as a gavel a 4-in. shrapnel shell. Mr. Franklin introduced Naval Constructor George H. Rock, U. S. N., of the New York Navy Yard, who took for his subject "The Ventilation of Battleships." Naval Constructor Rock gave a comprehensive review of the problems that have to be met in the ventilation of battleships, one of the most important being the prevention of pipe corrosion. He also told how the use of steam radiators aboard ship had given place to the indirect systems which are now in universal use.

One of the most interesting statements made was that the ventilation of ships on any large scale is a development of the past few years and that this applies to the vessels of foreign countries as well.

The main portions of Captain Rock's address were withheld from publication.

President Ritter stated that the May meeting on May 21, would be in charge of a committee headed by George W. Martin, of the engineering firm of Martin and De Remer, New York. Efforts are being made to secure as the principal speaker an army engineer-officer to talk on "Military Preparedness."

Illinois Chapter Discusses Smokeless Boilers.

"Noven Types of Heating Boilers" was the topic for the April meeting of the Illinois Chapter which was held at the Engineers' Club, Chicago, April 9. The American Radiator Company's smokeless boiler was described by H. L. Whitelaw; Charles F. Newport of the Newport Boiler Company gave an illustrated address on magazine boilers; and Ernest Mehring, president of the Ernest Mehring Co., Chicago, representing the Kanawha Mfg. Co., of Charleston, W. Va., also gave a talk, illustrated with slides, on smokeless boiler construction and operation. These speakers were followed by Osborn Monnett, formerly chief of the Chicago Smoke Inspection Department, who stated that efficient operation of boilers, whether for high or low pressure plants, was essential in lowering smoke densities.

In the absence of President Powers, Dr. E. Vernon Hill, vice-president, officiated.

A committe was appointed to take charge of the entertainment at the forthcoming semi-annual meeting of the society which will be held in Chicago, July 18-20. This committe will consist of James Cutler, Benjamin Nelson, E. J. Claffey and August Kehm.

Secretary Stacey anounced the election of the following to membership in the chapter: Oliver L. Bear, A. A. Blomfeldt, H. W. Nelson, F. Van Inwagen and H. L. Whitelaw.

John F. Hale, who had represented the chapter at the recent convention of the National Committee on Engineering Co-Operation, held in Chicago, March 29, said that he expected to be able to make a report covering various points which have developed in connection with engineering co-operation. This report will be presented at the summer meeting of the heating engineers' society.

Annual Meeting of Eastern Pennsylvania Chapter.

The annual meeting and dinner of the Eastern Pennsylvania Chapter was held at Kugler's Restaurant, Philadelphia, March 8, and was largely attended. Officers elected were: President, George W. Barr; vice-president, J. T. J. Mellon; treasurer, H. P. Gant; secretary, George Boon.

D. Knickerbacker Boyd was the principal speaker, his address being devoted to a discussion of co-operation between the heating engineer and the architect.

A joint meeting of the local chapters of the American Society of Mechanical Engineers and of the American Society of Heating and Ventilating Engineers was held at the Engineers' Club, Philadelphia, March 27, both chapters being well represented. The feature of the meeting was the presentation of a paper on "Central Station Heating," by Walter J. Kline, of the American District Steam Company, in which he gave a concise review of up-to-date methods in this field.

The regular monthly meeting of the Eastern Pennsylvania Chapter, held April 12, was devoted to warm air furnace heating. A paper on the subject by Irwin F. Grumbein was well received. Mr. Grumbein renewed the claim that heating and ventilating by this method has many advantages for certain types of buildings. He also emphasized the necessity for proper installation of such systems.

The May meeting was scheduled for May 8 the subject for discussion being "Heat Regulation."

Kansas City Chapter Inspects Radiator Manufacturing Plant.

Thirty members and guests of the Kansas City Chapter met at the Tea Cup Rooms, Kansas City, for supper, after an inspection trip had been made to the plant of the Kansas City Radiator Company, where 6,000 sq. ft. of pressed metal radiation is being turned out per day. The manufacturing methods used and the design of the radiators were explained in detail to the visitors.

The members met later in the City Club rooms upstairs where the topic of the evening, "Boilers and Smoke Prevention," was discussed. Mr. Pease, of the Kewanee Boiler Company, exhibited a series of moving pictures which proved both amusing and instructive as illustrating the experiences with a "smoke producing" boiler and one of the "smoke prevention" type.

Mr. Howe, of the American Radiator Company, then gave a talk on methods to be used to prevent the formation of smoke in boilers not of the smokeless type. These were the alternate firing on first one side and then on the other, the covering only of bright spots in the fire, the coking method of firing whereby the coal is heated gradually, and the double arching of boilers, making a greater travel of the gasses.

Mr. Booth, of the United States Radiator Corporation, gave a review of boiler construction since the days of Watt and brought out the fact that in Europe the development of hot water heating preceded that of steam.

A general discussion showed that the so-called "smoke consuming boiler" is a misnomer, as it should really be called a "smoke prevention boiler," as the idea is to prevent smoke, for smoke once formed in a boiler is almost impossible to consume.

As a member of a committee reporting to the city council on a proposed boiler code, which in all probability will be adopted, Mr. Howe stated that the code recommended was that proposed by the American Society of Mechanical Engineers, which has already been adopted in 25 States, and is tending to make uniform the legal requirements and inspections of boilers, besides producing more like a standardization of output by the manfacturers. Secretary F. A. De Boos was instructed to write Mayor Edwards endorsing his efforts to secure the appointment of a smoke inspector in Kansas City. It was brought out

that as it is an admitted fact that house heaters produce as much as 75% to 90% of the smoke in our cities, there can be no question that proper smoke inspection will materially lessen the smoke nuisance. This has become an item of considerable importance in Kansas City during the last two years on account of the apparent failure of the natural gas supply, which was largely used in house heating.

Five new applications for membership in the chapter were received and the applicants elected, making the chapter's present membership, 35.

CORRESPONDENCE

Figuring Exhaust Steam Supply From Engines.

EDITOR HEATING AND VENTILATING MAGAZINE:

How much direct radiation can be supplied and what is the thermal efficiency of the exhaust from a 100 H.P. simple automatic cut-off governor engine, operating at 100 lbs. gauge pressure, back pressure at atmosphere, requiring 40 lbs. of steam per indicated horse power?

In Carpenters' work on "Heating and Ventilating" there is given a table covering this condition which shows that practically 10,000 sq. ft. of radiation can be supplied. An empirical rule, but one which coincides very closely with experience is that 100 sq. ft. of direct radiation requires the consumption of 3 tons of hard coal per heating season, consequently 300 tons would represent the amount necessary for the 10,000 sq. ft.

Another authority attacks the problem from a different angle, stating that this type of engine, using 40 lbs. of steam per i.h.p., operating 10 hours a day and estimating a heating season of 200 days, will exhaust 80,000,000 lbs. containing 1,121 B.T.U. per pound or a total of 8,968 millions B.T.U., during the period named. If this quantity of steam were separately generated with coal having a caloric value of 12,500 B.T.U. per pound, and a boiler efficiency of 60%, each pound of coal would produce 7,500 B.T.U. of steam, thereby requiring 1.2 millions pounds of coal or 600 tons. Wherein does the descrepancy lie between these two results?

Schenectady, N. Y. D.

The question presented by our correspondent is not entirely clear, not so much as to the method of figuring, but as to just what conditions are to be considered. It is assumed that the question was intended to ask "how many square feet of equivalent direct radiation can be supplied by the exhaust steam from a 100 H.P. engine using 40 lbs. of steam per indicated horsepower *during the time of its operatoin at full load.*" It is obvious that when the engine is operating at full load it consumes 40 lbs. of steam per I.H.P. and for 100 I.H.P. will consume 40 x 100, or 4,000 lbs. per hour. If operated at only one-half the load, approximately one-half the amount of steam is used and since the weight of exhaust steam cannot exceed the weight of the consumed steam it follows that at full load about 4,000 lbs. of exhaust steam would be available, while at lesser loads smaller amounts, nearly proportional to the load, would be available. Of course when the engine was not in operation no exhaust would be available and a make-up through a pressure reducing valve would have to be used.

Steam exhausted at exactly atmospheric pressure will not circulate through a system of steam piping unless assisted by a vacuum pump or other aid. However, assuming such a condition *could* be obtained and steam at exactly atmospheric pressure drawn into a heating system, then the amount of surface is most easily computed by dividing the total amount of steam available by the amount condensed per square foot of direct *cast-iron* radiation.

It is well known that the condensation per square foot of ordinary radiator surface is about ¼ lb. and that with allowance for loss in piping this will increase to about ⅓ lb. per square foot. So with 4,000 lbs. of steam available at full load and ⅓ lb. condensed per square foot about 4,000 × 3, or 12,000 sq. ft. could be supplied. With surface in the shape of *pipe coils* less could be handled owing to their greater condensing power which is about 300/250 or 1.2 times that of *cast-iron* surface. So 12,000/1.2 = 10,000 sq. ft. of surface for pipe coils. On account of small losses in the engine and the possibility of slightly higher condensing ability in some parts of the system we could not recommend over 95% of the above, say 11,400 sq. ft. for *cast-iron* surface, or 9,500 sq. ft. for *pipe coil* surface.

We do not agree with our correspondent that "100 feet of direct radiation requires the consumption of 3 tons of hard coal per heating system," for it has been found that 100 lbs. per square foot of surface is

a very close figure for heating work in New York and vicinity where the winter season is considerably more mild than in Schenectady. This would increase our correspondent's empirical rule to 5 tons per 100 sq. ft. or 500 tons for 10,000 sq. ft. of equivalent direct radiation.

The authority who estimated on the engine operating "10 hours per day" left the heating system cold for the other 6 hours during extreme weather (assuming the heat as being on from 6 a. m. to 10 p. m. for zero temperatures outside) and on the other hand made no allowance in his average figures for the year for the average yearly temperature during the winter period of 200 days, this being about 35° F. or just 50% of the maximum. Following the same method of reasoning as used by the authority quoted by our correspondent but with quantities that we consider as found more correct in average practice the following is obtained:

Hours per day (maximum) when heat is required	16
Hours per day (maximum) for engine operation	16
Heating days per season	200
Average heat for season in terms of the maximum	50%
Total heating hours per season 200 × 16 × 50% equals	1600
Total pounds of exhaust steam at 100 H.P. for 200 days of 16 hours each, 40 × 100 × 200 × 16	12,800,000
Utilized in heating system 50% of maximum	6,400,000
B.T.U. avaliable from each pound of coal, 12,500 × 60%	7,500
B.T.U. in 6,400,000 lbs. of steam at atmosphere 6,400,000 × 1,121.	7,174,400,000
Equivalent pounds of coal utilized for heating during season 7,174,400,000/7,500	956,000
965,000 lbs. of coal reduced to tons 956,000/2,000	478 tons

This comes very close to the 500 tons obtained by the other rule.

As far as "thermal efficeincy" is concerned, it is presumed our correspondent refers to the amount of heat contained in the exhaust steam as compared to what could be extracted from it if it had not passed through the engine. In this connection it is necessary to take the B.T.U. of 1 lb. of steam at 100 lbs. gage pressure (1189) and the B.T.U. of 1 lb. of exhaust steam at atmosphere (1151), the other B.T.U. being utilized in the engine, and this gives a thermal efficiency of 1151/11.89, or 96.8%.

Heat Transmitted by Indirect Stacks.

EDITOR HEATING AND VENTILATING MAGAZINE:

In THE HEATING AND VENTILATING MAGAZINE for January, 1917, in the article on "Utilizing Waste Heat for Drying Purposes," it is stated (on Page 21) that "the radiating surface is 176 sq. ft. (per stack) and the two stacks gave off 1,053,000 B.T.U. per hour." This would make the heat transmitted per square foot per hour 1,053,000 — (176 × 2) = 3000 B.T.U. This seems very high. Is there not an error here?

Montlucon, France. A. L.

As this installation was designed by the engineering department of the Clarage Fan Co., Kalamazo, Mich., the foregoing inquiry was referred to the author of the article, who writes as follows:

"We have accurate data that the fan is delivering 6,750 cu. ft. of air per minute and at 20 deg. F. 1 cu. ft. of air at 14 7/10 lbs. atmospheric pressure weighs 0.08258 lbs. The temperature rise has been checked and this is from 20 deg. to 152 deg., which gives a rise in temperature of 132 deg. In addition, the specific heat of air at constant pressure is 0.2375.

"With these data, by multiplying the 6,750 cu. ft. per minute by 0.08258, we obtain 559 lbs. of air handled per minute. Multiplying this quantity by 60, we obtain 1,057,000 B.T.U. per hour. This checks fairly closely with our previous computation. All computations submitted have been made with the slide rule.

"If it is desired to check the amount of heating surface in the stacks, we believe the data given in the article is sufficient and we see no reason why 3,000 B.T.U. per hour per square foot should not be transmitted under the conditions."

Professor C. R. Richards, professor of mechanical engineering and head of the department since 1911, has been appointed dean of the College of Engineering and Director of the Engineering Experiment Station of the University of Illinois to succeed Dr. W. F. M. Goss who has resigned to become president of the Railway Car Manufacturer's Association of New York.

An increase of 50% in first-class postage rates, but not less than one cent additional on each piece of first-class matter, is proposed by the finance committee of the United States Chamber of Commerce as a means of helping to meet the taxes on war loans. It is estimated that this tax would produce $100,000,000 a year.

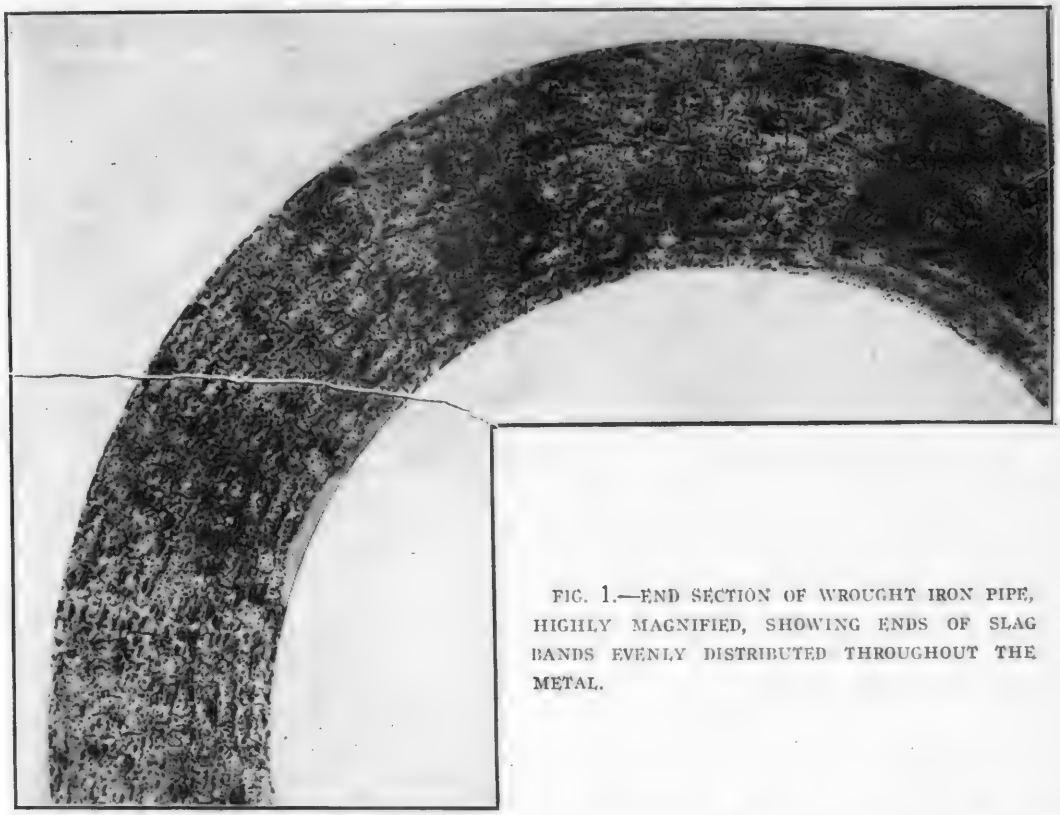


FIG. 1.—END SECTION OF WROUGHT IRON PIPE, HIGHLY MAGNIFIED, SHOWING ENDS OF SLAG BANDS EVENLY DISTRIBUTED THROUGHOUT THE METAL.

The Relation of Slag to the Rust Resistance of Wrought-Iron.

That the reason for the rust resistance of genuine old-fashioned wrought-iron appears to many to be shrouded in uncertainty is probably due to the expectation of finding it deeply buried in a maze of metallurical mysteries. Such, however, is not the case as the following facts will show.

Genuine wrought-iron, as shown in the photomicrograph of an end section of pipe, Fig. 1, contributed by A. M. Byers Company, Pittsburgh, Pa., is composed mainly of iron and slag, the slag appearing black or dark gray and the iron light gray. It is to this slag, which is non-corrosive and electrically almost inert, that genuine wrought-iron owes its resistance to corrosion, as rust can only destroy the iron, not the slag. Allowing for the magnification a little calculation will establish that there are over a quarter of a million slag bands to the square inch, making it easy to understand why they offer such an effective barrier to the entrance of moisture and oxygen, the two most potent factors promoting corrosion.

The protection afforded by the slag contents of genuine wrought-iron, about 6% by volume, has its counterpart in the graphite flakes (Fig. 3) found in pig-iron; pig-iron rusts very little.

The rusted area indicated by the cross lines in Fig. 1 represents the starting of a pit. A glance will show how the individual slag streaks at this point form an almost unbroken barrier with no opening actually larger than .001 in. This illustrates why genuine wrought-iron tends to rust evenly all over, for the corrosion, proceeding along

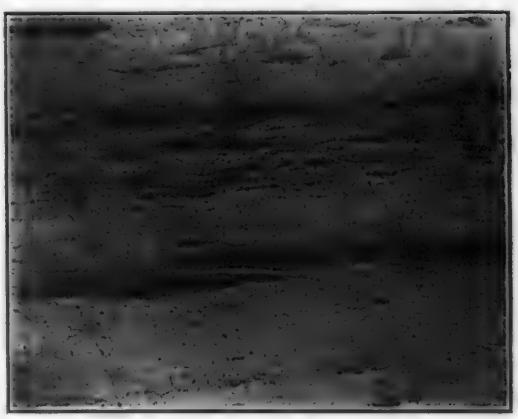


FIG. 2.—LONGITUDINAL SECTION OF WROUGHT IRON PIPE, HIGHLY MAGNIFIED. DARK PORTIONS ARE SLAG BANDS.

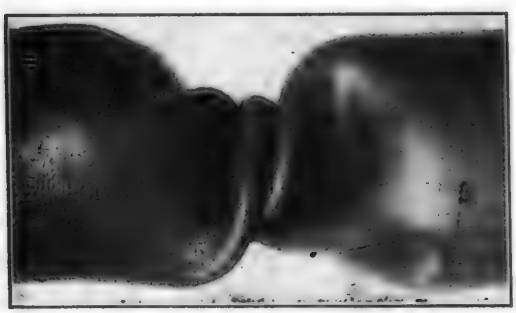
the lines of least resistance, tends to spread out instead of going deeper. Without the slag, nothing could retard or stop the pit, which would soon go straight through the pipe and cause an untimely leak.

FIG. 3.—SECTION OF PIG-IRON, HIGHLY MAGNIFIED, SHOWING CHRYSTALLINE STRUCTURE PROTECTED FROM CORROSION BY GRAPHITE FLAKES.

The scientifically inclined reader, however, is liable to interpose the objection that there are large open spaces between the individual slag streaks. True, there are open spaces, but most of them are considerably smaller than 1/1000 in., smaller than the smallest pinhole.

Torsional Strength of "National" Pipe.

At first glance, the accompanying photograph looks like a piece of rubber. Instead, it is a piece of 8-in. "National" line-pipe after being subjected to a torsional stress of 713,000-in.-lbs. 8-in. line-pipe weighs in the neighborhood of 29 lbs. per foot and the walls have a thickness of approximately ⅓ in. This will give some indication of the quality of the material used in this pipe to enable it to withstand the enormous strain to which it was subjected. It is brought to the attention of the trade by the manufacturer, the National Tube Co., Pittsburgh, Pa., as a curiosity and an eye-opener to many pipe users who have probably not believed that 8 in. "National" pipe could be subjected to such extraordinary punishment without failing.



8-IN. "NATIONAL" LINE-PIPE AFTER BEING SUBJECTED TO TORSIONAL STRESS OF 713,000-IN.-LBS.

Current Heating and Ventilating Literature.

Under this heading is published each month an index to the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

AIR

The Physical Properties of Air in Relation to Practical Problems. H. Eisert. 3000 w. E Cb Balt, Jl—Feb., 1917. Serial, 1st part. Properties of air in their relation to its most important uses. 40c.

AIR DRYING

Air Drying. Carl Hering. 4500 w. Met. & Chem. Eng.—Feb. 15, 1917. Methods of drying. 40c.

HEATING

Heating Chicago's Tuberculosis Sanitarium. Thomas Wilson. Ills. 1500 w. Power—Feb. 27, 1917. Interesting installation serving 56,000 sq. ft. of direct radiation. 20c.

POWER PLANTS

Power Plant of Wm. L. Dickinson High School. John C. Calahan. Ills. 1500 w. Nat. Engr.—Feb., 1917. Modern methods of heating, lighting, ventilating, power and sanitary equipment. 20c.

School Plant for Power, Heatng, and Ventilation. Ills. 2000 w. Prac. Engr.—Feb. 15, 1917. Combination heating system. Air pressure water supply and other features. 20c.

STEAM PLANTS

Power Equipment for Steam Plants. Robert L. Streeter. Ills. 4500 w. Ind. Man.—March, 1917. Seventh part of a serial. Some auxiliaries necessary for economical operation. 40c.

New High-Pressure Central Steam Plant. Claude Hartford. Ills. 1800 w. Power—Feb. 6, 1917. Station at Burling Slip, New

York, for supplying steam to many large buildings. 20c.

WASTE HEAT

The Utilization of Waste Heat for Steam-Generating Purposes. 2200 w. A S M E, Jl—Feb., 1917. Discussion of Arthur D. Pratts' paper, with closure. 40c.

New Books.

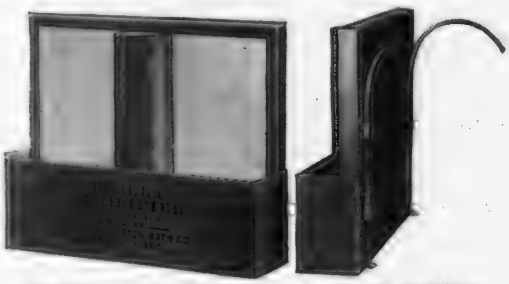
STEAM PIPING, its economical design and correct layout, by A. Langstaff Johnston, Jr., is the title of a new book forming one of the volumes of the Industrial Management Library. The subject matter comprises a series of articles that appeared in *Industrial Management* during 1915, as consolidated and revised. The author analyzes the factors governing the flow of steam in pipes, and presents a group of curves for use in solving the problems of practical installation and determining the most economical size of pipe to select for any given set of conditions. The pressure-drop curve is based on the formula in Babcock & Wilcox's handbook, "Steam." Two of the chapters take up, respectively, the special problems of low pressure systems and the economies to be obtained through the use of exhaust steam; also the use of the plain reciprocating engine, with exhaust heat as a by-product, in place of more costly equipment. The curves, which are easily the most important feature of the book, are in some cases printed separately, a special container being added to the back cover to hold them. The size sheet required, in one case, measures 24 x 15 in. Size 5 x 7½ in. Pp. 62. Price $2.00. Published by the Engineering Magazine Co., New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

MECHANICAL EQUIPMENT OF SCHOOL BUILDINGS, by Harold L. Alt, is a compilation, in book form, of a series of articles that appeared recently in the *American School Board Journal*. The book expresses throughout the author's own experience as a designing and supervising engineer. Chapters are included on heating and ventilation, ducts and flues, plumbing fixtures, water supply systems, fire protection, drinking water, sewage disposal, the school power plant, the school swimming pool, electric lighting and vacuum cleaning. Variations in approved, up-to-date practice are allotted equal prominence giving the reader his choice in the final selection. The chapter on "School Power Plant," emphasizes the advantages of such plants. Illustrations are given of the equipment of a typical power plant installed in 1915 in a high school in an Eastern city, which has operated successfully and economically. Size 8 x 10¾ in. Pp. 108 and index. Price, $2.50. Published by the Bruce Publishing Co., Milwaukee, Wis., or may be had through the book department of THE HEATING AND VENITLATING MAGAZINE.

NEW DEVICES

Another New Radiator Humidifier.

The accompanying illustrations show the construction of the Eureka humidifier which has been placed on the market by the Eureka Blotter Bath Co., Chicago, Ill. It comprises a metal receptacle, a frame and a vapor stone, the surface of which is made of ground stone and charcoal and forms an evaporating surface for the moisture



EUREKA HUMIDIFIER, SHOWING VAPOR STONE AND FILLER. BACK OF EUREKA HUMIDIFIER.

held in the pan. It is pointed out that the dehumidifying properties of this device are a notable feature, it having been found that excess moisture in the air will be absorbed by the stone. There is a filling funnel in the center so arranged that the pan can be easily filled without removing the device from the radiator.

Trade Literature.

MOLBY MAGAZINE-FEED DOWN-DRAFT BOILERS, made by the Molby Boiler Co., New York, under the Surrell patents, are featured in a new catalogue, which shows the latest types of construction. This boiler, which is made of cast-iron, is manu-

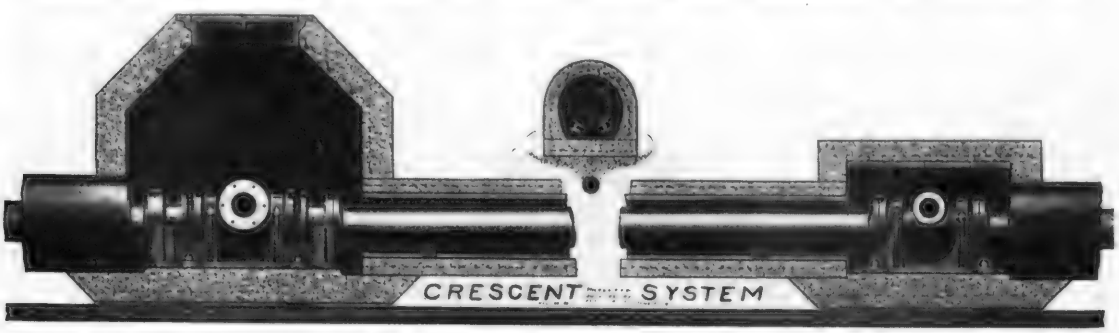
factured in three sizes, 26-in., 31-in. and 47-in. The 26-in. series differs from the others only in having one magazine, while the 31-in. and 47-in. have two magazines, one on each side. One advantage of the two-magazine feature is that it permits one or two fires to be carried as desired. All of these boilers, it is pointed out, burn the cheaper grades of fuel, such as pea coal or bituminous nut or slack under 2-in. in diameter, and without smoke. The fire is all on one grate thus preventing fresh bituminous coal falling through holes in the fire to the ash pit or to a lower zone where they might create smoke. The catalogue is accompanied by complete data tables for the entire line, both water and steam. Size 4 x 9 in. Pp. 16.

THERE IS A RADIATOR IN THIS ROOM. CAN YOU FIND IT? is the title of a circular devoted to the Ja-Nar', the "automatic heat control," manufactured by the Fulton Co., Knoxville, Tenn. The illustration referred to shows a sitting room with the window radiator concealed from view by this interesting radiator enclosure and temperature regulator. The Ja-Nar' is made in different finishes to match the furnishing or the woodwork of the room. It consists of an insulated cover, with the necessary regulating mechanism for opening and closing the louvres in the casing by which the heat emission is controlled. The point is emphasized that no plumbing or steam fitting is necessary in installing the Ja-Nar', it being simply placed over the radiator. There is also no operating expense. No electric current is used and there are, therefore, no batteries to renew.

USES OF "NATIONAL" PIPE, illustrating by photographs hundreds of uses for this product, is the subject of a recent bulletin (No. 27) issued by the National Tube Co., Pittsburgh, Pa. "Who will attempt to compile a complete list of the uses of wrought pipe?" asks the bulletin and the magnitude of such an undertaking is realized when reference is made to the illustrations which show literally over 1,000 such applications. A foreword in the bulletin gives a summary of the rise of "National" pipe, which dates from 1868. During the ensuing fifty years, adds the bulletin, the annual manufacturing capacity has increased to 1,500,000 tons of "National" pipe and allied tubular products, soon to be increased to another 500,000 tons yearly by the capacity of the new self-contained $25,000,000 National Tube Company mill, at Gary, Ind. A brief review is also given of the researches and experiments that led the company to abandon the manufacture of wrought-iron pipe in favor of wrought steel. The bulletin includes some 15 pages of pipe data. Size 8½ x 11 in. (standard). Pp. 52.

CRESCENT SYSTEM OF MODERN HEATING, for central stations, universities, industrial plants and public buildings, is the subject of a cloth-covered catalogue, issued by the manufacturers, W. H. Pearce & Co., Chicago, Ill. This system consists of especially-designed conduits, expansion sleeves, anchors, traps, valves, ball-bearings, ball and angle joints, pipe collars, pipe insulation and other devices used on the inside of buildings, such as valves, heaters and temperature regulators. Illustrations and descriptions of these devices, together with numerous views of typical installations give a comprehensive idea of the advantages of the Crescent system. Size 6 x 9 in. (standard). Pp. 60.

MODERN HEATING BY MEANS OF PRESSWELD RADIATION is the title of a newly-issued catalogue devoted to the Pressweld line of "radio" alloy sheet metal radiators. Pressweld radiation, it is stated, "has made good and has been endorsed by the nation's leading engineer and architects." Illustrations and descriptive data are given of several of the standard types and sizes of Pressweld units supplied, also a broken view showing the points of welding at the seams and between sections. Full details regarding tappings and dimensions are included, the

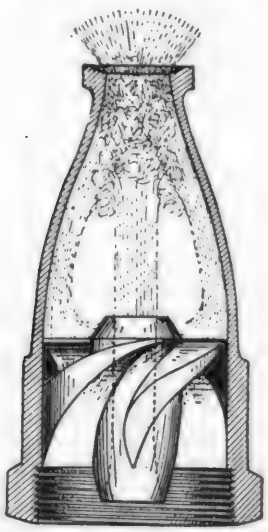


CRESCENT CONDUIT CONSTRUCTION FOR UNDERGROUND PIPE LINES.

catalogue closing with a report of an interesting corrosion test, made last year at the Detroit Testing Laboratory. In this test a specimen of special radio alloy metal was compared with specimens of mild steel and cast-iron, with the following results:

Specimen No. 1—Cast Iron:
Shows a loss in weight after 24 hours immersion—
In 10% Hydrochloric Acid Solution 18.08%
In 10% Sulphuric Acid Solution ..18.47%
Specimen No. 2—Mild Steel:
Shows a loss in weight after 24 hours immersion—
In 10% Hydrochloric Acid Solution 4.37%
In 10% Sulphuric Acid Solution .. 6.50%
Specimen No. 3—Special Radio Alloy Metal:
Shows a loss in weight after 24 hours immersion:
In 10% Hydrochloric Acid Solution 1.06%
In 10% Sulphuric Acid Solution .. 0.36%

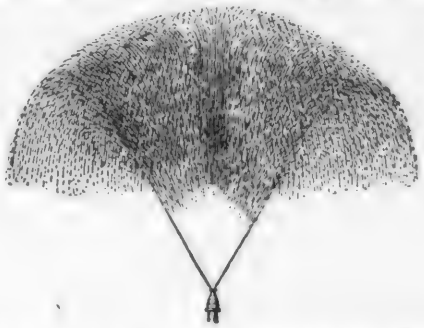
The conditions of temperature solution (70° F.) length of immersion and strength of acid were identical in all cases. These comparative acid and corrosion tests, it is pointed out, demonstrate a decided superiority in favor of the special alloy metal, so far as resistance to corrosion is concerned. The Pressweld line is manu-



SPRACO NOZZLE

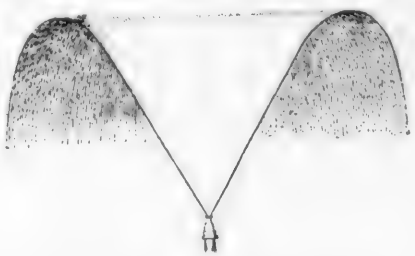
factured by the American Pressweld Radiator Corporation, Detroit, Mich. Size of catalogue, 5¼ x 8¾ in. Pp. 24.

SPRACO PRODUCTS, including spray cooling equipment, air washing and cooling equipment and paint spraying equipment, are presented in a new catalogue (Bulletin 501) issued by the Spray Engineering Co., Bos-



SOLID CONICAL FORMATION PRODUCED BY SPRACO NOZZLE

ton, Mass. In a description of the salient features and design of the Spraco nozzle it is pointed out that a part of the liquid in passing through the nozzle is given a rapid rotating motion by the turbine center, and is driven forth through the orifice in the form of a dense, uniform spray by the



HOLLOW CONICAL FORMATION

centrifugal driving jet. This jet in impinging on the rotating water in the mixing chamber near the orifice entirely fills the center of the spray, giving it a solid conical formation of equal density across its section. Size 8 x 11 in. Pp. 16.

BLACKMAN AND DUPLEX CONE FANS, described as the outcome of thirty years' work, are featured in a carefully-compiled catalogue (No. 180) received from Howard & Morse, New York. Numerous tables covering the different sizes are included, showing horse-power requirements and speeds, all of which are guaranteed by the manufacturers. The concluding section of the catalogue is devoted to the Duplex cone fan for maintaining any pressure involved in any plenum or exhaust system of heating or ventilation. Size 8 x 11 in. (standard). Pp. 24.

"NATIONAL PREPAREDNESS," is the title of a clever wall-hanger calendar, containing an

illustrated poem by Berton Braley, glorifying the part played by "National" pipe in the present age of the generation and transmission of power. The theme of the poem is well-expressed in the line, "Framework of civilization is wrought of it." The hanger is issued by the National Tube Co., Pittsburgh, Pa.

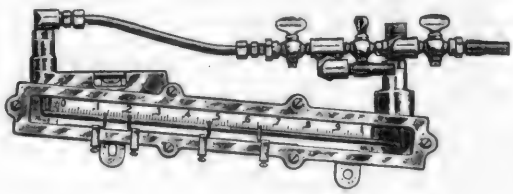
PARKER EXPANSION BOLTS, made by the Parker Supply Co., New York, are called to the attention of the trade in a series of three blanket circulars, bringing out the

PARKER EXPANSION BOLTS.

important points of this line. The line includes the lag-screw type, the machine bolt type (single and double and with bottom bearing) and the wood-screw type. The first bulletin presents the complete line, while the second bulletin lays emphasis on the projections on the shield which prevent it from turning in the hole while the bolt is being put in. It is stated that the projections bite deep into the masonry in opposite directions, resulting in a firm grip. Circular No. 3 calls attention to the clear-cut castings from which the Parker expansion shield is assembled. This, it is stated, comes from using better pig iron, molding by machine, annealing with great care and cleaning by sand-blasting.

Ellison Draft Gauges.

A line of 15 types, comprising in all 200 different gauges, is now included in the product of Lewis M. Ellison, 214 West Kinzie St., Chicago, Ill. Among the con-



ELLISON COMBINATION DIFFERENTIAL DRAFT GAUGE.

structive features, which, it is stated, give a remarkable degree of accuracy to this type of gauge, are that they have no mechanism for multiplying the scale of indications, but are equipped with an inclined tube with oil of constant capillary attraction, lubricating the surfaces and traveling without friction over a single-reading scale, self-correcting for capillary attraction and specific gravity, indicating equivalent water pressures direct without factor. By this arrangement it is claimed at that an accuracy is obtained never attained in any other form, type or make of draft gauge.

All model 1916 draft gauges are made with self-lining ears, designed to relieve the gauges of twisting strains. They are ordinarily made of aluminum, with scales of white metal in black graduations. The full line includes the open type and cover type, and several differential types, including one whereby the furnace draft, the flue draft or the differential between the flue and furnace is independently indicated on a single-tube gauge. The Ellison line is described in a 40-page booklet, recently issued by the manufacturer.

Sylphon Regitherm Manufactured by the Fulton Company.

The Ideal Sylphon regitherm which, as described in these columns last month, is used with success in controlling the temperature in central station heating systems, is manufactured by the Fulton Company, Knoxville, Tenn., under patents taken out by W. M. Fulton, and not by the American Radiator Company, as was stated in the article. The American Radiator Company acts as exclusive distributor for the device.

Trade Journals Pledge Services to the Government.

Up to date 277 class journals in the United States have pledged their services to the Government in giving editorial co-

operation and free advertising space. The telegrams offering this co-operation were taken to Washington April 17 by a committee of the New York Business Publishers' Asociation, headed by Arthur J. Baldwin, of New York. They were received by Secretary of War Daniels and by other officials in the War Depaitment. It is proposed to keep closely in touch with the Government in its work and to secure wide publication of matters for which the government desires extended publicity.

Providing for War Dependents.

In a letter to the Chamber of Commerce of the United States, Secretary of War Baker urges that employers of labor make only temporary arrangements with their employees until such time when it is hoped some uniform system can be suggested which will adequately take care of the situation. It was found that, in some cases, some employers were paying full wages in addition to the army compensation. Another solution was paying the difference between the army wage and that previously received by the employees. The Chamber of Commerce will immediately organize a special committee to make an investigation of this matter and the secretary of war has asked that the results of such an investigation be reported as soon as possible to the War Department, together with such advice as the commitee feels authorized to give.

BULLETIN OF THE NATIONAL DISTRICT HEATING ASSOCIATION for April, 1917, features the programme of the forthcoming convention of the association in Detroit, June 12-15. There is also a letter from President Byron T. Gifford calling attention to the effect on the central station heating industry of the increased costs of materials, fuels and labor requiring a revision of past cost records and rate schedules. The rate question, he states, will be an important subject of discussion at the convention. The leading article is the description of the "New Station of the New York Steam Company," written by Claude Hartford, one of the company's sales engineers.

American Heating Specialty Co., Peru, Ind., has taken over the business of the Tillman Heating Devices Co., of Indianapolis. The company is also placing a new tank-in-basement method of hot water heating on the market.

Central Station Heating Notes.

Ishpeming, Mich.—President William Leininger of the Ishpeming Advancement Association is agitating the proposition of establishing a central station heating system for the business district of Ishpeming. A canvass has already been made of the downtown section, with favorable results.

Virginia, Minn.—The city council has voted favorably on a recomemndation from the water and light commission that the city build a municipal heating plant. It was decided to issue certificates of indebtedness to the amount of $110,000 to pay for the plant which, it is claimed, will pay for itself in 15 years.

Cleveland, O.—Utilities Director Farrell has instructed the water department engineers to investigate the feasibility of using the Fairmount steam heating plant for the manufacture of ice during the summer months.

Providence, R. I.—Work is under way on plans for the central heating plant to be built to supply the new high school building and the three present structures. Bids on the high school will await the completion of the heating plans, according to Chairman Percy A. Harden, of the city council property commitee, as the erection of both buildings at the same time will be necessary since the high school will be without heat until the central plant is in operation.

New Ulm, Minn.—In a report submitted to the city council by F. W. Johnson and A. J. Vogel, directors of the New Ulm Heating Company, it is estimated that the total cost of the municipal heating plant is $26,286.

Des Moines, Ia.—The heating franchise asked for by the Des Moines Electric Company, which was submitted to the voters at a special election March 26, passed successfully by a margin of 1331 votes. The proposal was favored by the Chamber of Commerce but was opposed by organized labor, a campaign against the measure being conducted by the Trades and Labor Assembly. Following the election a delegation from that organization visited the council with a demand that an investigation be made of the election and rumors of a grand jury investigation were heard. The poll book for the nine precincts of the First Ward were found missing. The contest, if successful, might invalidate not only the franchise election, but also the vote on the bond issue as well.

Indianapolis, Ind.—Construction work will begin shortly on the new six-story concrete and steel power plant of the Indianapolis Light & Heat Company, to be erected near its present plant on Kentucky Avenue. The building will be 200 ft.

long and 100 ft. wide and wil cost $200,000. It will be completed by October 1. When the new building is finished, the present power house will be torn down and the second half of the proposed plant will be built. The entire building will house equipment sufficient to maintain two 30,000 H.P. units, a boiler room capacity for 800 H.P. steam boilers and space for other equipment to make up a complete power plant. The new boilers will have a limit of 250 lbs. steam pressure and 200° F. superheat.

Kansas City, Kan.—Work on the foundation for the $350,000 addition to the Kansas City Light & Power Company's heating plant is completed and construction on the building itself will start immediately. The addition will be completed by next fall.

Davenport, Ia.—The People's Light Company, which recently took over the heating franchise of the Davenport Gas & Electric Company, will spend $100,000 this summer in the reconstruction of the system, including the steam mains.

Byron T. Gifford Opens Consulting Engineering Offices.

Byron T. Gifford, president of the National District Heating Association, has opened offices as consulting engineer in the Grand Rapids Savings Bank Building, Grand Rapids, Mich. Mr. Gifford and his associates are making a specialty of rate studies and investigations relative to public utility companies and especially in connection with central heating companies which at this time are particularly interested in rate questions.

Mr. Gifford's experience has been broad and he is well-known in his profession. Seymour W. Cheney is associated with Mr. Gifford. Mr. Cheney has been engaged in public utility work for twelve years in the design and operation of properties.

Both Mr. Gifford and Mr. Cheney were formerly associated as chief engineer and assistant engineer, respectively, of the American Public Utilities Company.

Standard Heating and Ventilating Data Sheets.

Previously-published data sheets, similar to those appearing herewith, are as follows:

FEBRUARY, 1917 ISSUE.

No. 1—B.T.U. Losses.
No. 1-A—B.T.U. Losses—Brick.
No. 1-B—B.T.U. Losses—Stone and Concrete.
No. 1-C—B.T.U. Losses—Combinations.

MARCH, 1917 ISSUE.

No. 1-D—B.T.U. Losses—Tile.
No. 1-E—B.T.U. Losses—Frame Construction.
No. 1-F—B.T.U. Loses—Glass, Skylight and Miscellaneous.
No. 1-G—B.T.U. Losses—Ceiling, Floor and Roof.

APRIL, 1917 ISSUE.

No. 2—Exposure.
No. 3—Leakage.
No. 4—Temperature Range.
No. 4-A—Temperature Range.

Copies of these sheets, printed, separately, on one side only, may be obtained at 5 cents each. The attention of readers is also called to the special binder for holding these sheets. The price of the binder is $1.00, postpaid.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE, published monthly at Cooperstown, N. Y., for April 1, 1917.

State of New York, } ss.
County of New York. }

Before me, a notary in and for the State aforesaid, personally appeared A. S. Armagnac, who, having been duly sworn according to law, deposes and says that he is the Editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York.
Editor, A. S. Armagnac, 1123 Broadway, New York.
Managing Editor, None.
Business Manager, Gustave Petersen, 1123 Broadway, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)
Heating and Ventilating Magazine Co., 1123 Broadway, New York.
A. S. Armagnac, 1123 Broadway, New York.
Gustave Petersen, 1123 Broadway, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:
None.

4. That the two paragraphs net above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 29th day of March, 1917.
A. L. Scantlebury, No. 173,
Notary Public, Kings County.
Certificate filed in New York County.
(My commission expires, March 30, 1919.)

COMPUTING HEAT LOSSES.

There is only one method which can produce accurate results in the computation of heat losses and that is the B.T.U. system. The accuracy of the results attained by using B.T.U. is only limited by the accuracy of the designer in computing the areas of his surfaces and the correctness of his factors for the given construction. All rules of thumb give approximate results only and these usually for certain standard-sized rooms of regular construction.

Heat will gradually transfer from a warm object to a cold one until the temperature of each is the same at which time the interchange of heat ceases. Thus a warm room loses heat to a colder one, to the outside air, to the attic, or to any other adjacent space where the temperature is lower than that maintained in the room.

A room will also absorb heat from an adjacent apartment if the apartment is kept at a higher temperature than the room. For this reason cold attics over warm rooms are generally figured as being at 40° F. if the rooms are 70° and the outside temperature zero. Similarly unheated space under a room is generally considered as being at 35° F. under similar conditions.

Thus to get the entire B.T.U. loss for a room *all* the surfaces separating the room from colder conditions must be counted as positive heat losses (the exact amount being the area exposed times the heat loss co-efficient CE times the difference in temperature between the two spaces) and *all* the surfaces separating the room from warmer spaces must be similarly figured as negative losses, the algebraic sum of the two giving the net radiation loss for southern exposure.

Outside walls and glass must have the exposure factor figured but on inside walls, glass, ceilings and floors it is not necessary to consider the exposure factor.

To the net transmission loss, with the proper increase for exposure must be added the leakage loss—if the room is unventilated—and the total will be the gross loss upon which to base the required radiator surface.

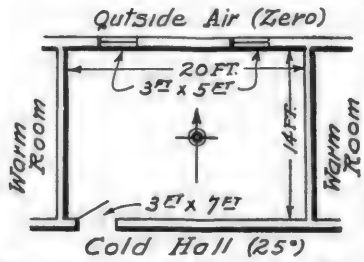
Briefly these may be summarized as follows:

SUMMARY OF B.T.U. METHOD OF HEAT LOSS CALCULATION.

1. Compute all wall surface exposed to the outside air in one direction only.
2. Compute all the glass and door surface in the same wall.
3. Subtract the glass and door surface from the gross wall surface leaving the net wall surface.
4. Multiply the glass surface by the proper factor for the temperature difference assumed.
5. Multiply the net wall surface by its proper factor similarly.
6. Add the wall and glass loss and increase for exposure as per the percentages given on Sheet No. 2.
7. Follow similar procedure for other outside walls.
8. Compute inside walls, ceilings, and floors where spaces on the other side are at temperatures different from the assumed room temperature, and multiply by proper factor for each construction and its respective temperature difference, making spaces warmer than the room negative losses.
9. Take the algebraic sum of all the losses computed and add leakage loss if room is unventilated. This will be the total B.T.U. loss.

Example of Computing by B.T.U. Method.

Problem: A room 14 ft. x 20 ft. x 10 ft. high, with only reasonable exposure, is to be heated to 70° F. in zero weather; it has a warm cellar below and a cold attic above; the construction is frame and the plan, as shown herewith.



The outside wall area is
20 ft. × 10 ft. ..... = 200 sq. ft.
The window area is 5 ft.
× 3 ft. ..... = 30 sq. ft.

Net area ..... = 170 sq. ft.

Frame house: loss for clapboards, paper, sheathing, lath and plaster for 70° — 0°, or 70° temperature difference = 16 B.T.U. (See Sheet No. 1-E.) Loss for glass, single thick, for 70° = 70 B.T.U. (See Sheet No. 1-F.)

Wall loss = 170 sq. ft. × 16 B.T.U. = 2720 B.T.U.
Glass loss = 30 sq. ft. × 70 B.T.U. = 2100 B.T.U.

Sum (for southern exposure) .... = 4820 B.T.U.

Room is unventilated and has north exposure. Therefore, the exposure factor (Sheet No. 2) is 15%, or 723 B.T.U. On the inside walls, all are warm except the hall wall which is 20 ft. × 10 ft. gross, or 200 sq. ft. The door equals 3 ft. × 7 ft., or 21 sq. ft. The net wall equals 179 sq. ft. Glass loss for 45° F. (Sheet No. 1-F) = 45 B.T.U. Wall loss for 45° F., for plastered stud walls (Sheet No. 1-E) = 15 B.T.U.

Inside wall loss = 179 × 15 = 2635 B.T.U.
Inside glass loss = 21 × 45 = 945 B.T.U.

Sum of inside wall losses = 3630 B.T.U.

As the cellar is warm no loss is figured on the floor, but with a cold ceiling (at 40° attic space above the ceiling) the area is 14 ft. × 20 ft. = 280 sq. ft. and the factor for 35° difference (Sheet No. 1-G) is 9 B.T.U. = 280 × 9 = 2520 B.T.U.

At one air change the cubic contents of 14 ft. × 20 ft. × 10 ft. = 2800 cu. ft. which at 70° F. (See Sheet No. 3) = 2800 × 1.27 = 3556 B.T.U. for leakage.

The total B.T.U. loss equals the sum of all the various losses computed, or:

	B.T.U.
Outside wall and glass	4820
Exposure	723
Inside wall and glass	3630
Ceiling loss	2520
Leakage	3556
15249	Total B.T.U. Loss.

VENTILATION.

Ventilation consists briefly of all the artificial air conditioning necessary to maintain the air inside of a building in a condition desirable for certain purposes (either for breathing or to suit given manufacturing processes) and at such standards as may be regarded as desirable.

The most common form of ventilation is that used to furnish an air supply (and sometimes an air exhaust) for the occupants of a building (without which the interior air would become foul) and also for the purpose of removing objectionable odors—such as in kitchens, restaurants and toilet rooms.

In past years the amount of carbonic acid in the air has been used to determine the comparative degree of purity even though it has been understood that carbonic acid itself is not dangerous. This is because pure air seldom contains over 4 parts in 10,000, while in air used for breathing purposes the number of parts rises rapidly and almost proportionately with the other impurities contained in exhaled air. Therefore, a statement of the amount of carbonic acid present in a given sample of air—a measurement comparatively easy to make—may be taken as indicative of the amount of other impurities also.

Each person gives off about 0.6 cu. ft. of carbonic acid per hour. If the fresh air entering a room has 4 parts in 10,000 of carbonic acid and the limit in the room is desired to be kept below a certain number of parts the number of cubic feet per minute per occupant must be not less than as follows

Limit of Parts of Carbonic Acid in 10,000 Parts of Air	Cubic Feet of Fresh Air Necessary per Minute Per Occupant.
5	133
6	67
7	44
8	33
9	27
10	22
11	19
12	17

While these are the theoretical amounts of air required, some consideration must be shown for the quantity of air contained in the room at the beginning of its occupancy and also the length of time the room is occupied. Thus, a church where the services are short and the volume of fresh air large at the beginning requires less air to ventilate than a moving picture theater running continuously for ten hours a day and usually in more or less cramped quarters.

Sheets Nos. 6-A to 6-E inclusive give the recommended number of air changes for various rooms in different types of buildings.

VENTILATION.

Number of Air Changes.

The table below shows the changes of air per hour, or the cubic feet per minute (C.F.M.) per occupant, recommended for various rooms in theatres, churches, moving picture halls, assembly halls and other places of congregation.

Churches

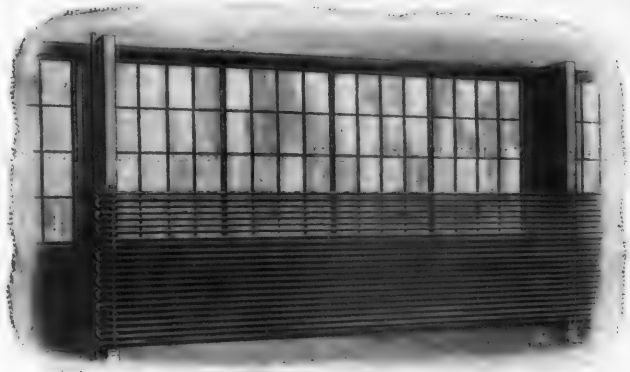
	Supply		Exhaust	
Room	C.F.M. Per Occupant.	Minimum No. of Air Changes.	C.F.M. Per Occupant.	Minimum No. of Air Changes.
Auditorium	20	...	20	...
Banquet	30	8	30	8
Coat and Locker	none	...	...	...
Sunday School	30	...	30	...
Social Rooms	30	8	30	8
Toilets	...	none	none	8 to 10
Theatres				
Auditorium	30	...	30	...
Lobbies	...	10	...	...
Retiring Rooms	...	4	...	4
Smoking Rooms	...	6	...	10 to 12
Toilets	...	none	...	8 to 10

Wall radiator heating superior to pipe coils

These two illustrations show very strikingly the many advantages of AMERICAN Rococo Wall Radiators over pipe coils for factory and warehouse heating.

These AMERICAN Rococo Wall Radiators in two tiers contain 360 square feet of heating surface; distance between pilasters, 26 feet; height from floor to window-sill, 5 feet. Radiators do *not* project above the window-sill.

AMERICAN Rococo Wall Radiators



This Pipe-coil made up of 2-inch pipe, twenty-four pipes high, contains 390 square feet of heating surface; distance between pilasters 26 feet; height from floor to window-sill, 5 feet. Pipe-coil projects 2½ feet *above* the sill.

can be erected on walls, ceilings, skylights and in narrow passage ways, on girders or columns and around windows —easily installed in small units to accommodate any spare space not otherwise usable.

Wall radiator units are easily rearranged, increased or diminished in size and permit of adjusting the heating supply to the weather demands —thus preventing much fuel waste and overheating.

Send for catalog "American Rococo Wall Radiators" —shows many ingenious installations which give most effective and economical heating results

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ADVERTISERS' INDEX

Air Moistener Co., The 81
Alberger Pump & Condenser Co. ... 82
Alberger Heater Co. 68
American District Steam Co. 87
American Blower Co. 79
American Radiator Co. 67

Bayley Mfg. Co. 82
Bicalky Fan Co. 14
Braemer Air Conditioning Corporation 72
Bristol Co., The .....Front Cover
Buffalo Forge Co. 7
Byers Co., A. M. 4

Carrier Engineering Corporation 8
Clarage Fan Co. .....Second Cover
Connersville Blower Co. 3

Davis Regulator Co., G. M. 90
Detroit Lubricator Co. 73
Dole Valve Co. .....Front Cover
Dunham Co., C. A. 14

Economy Pump Machinery Co. 84
Foster Engineering Co. 85
Fulton Co., The 11

Gurney Heater Mfg. Co. ...Front Cover

Hornung, J. C. 86
Houghton & Co., E. F. 5

Ilg Electric Ventilating Co. 74

Jenkins Bros. 71
Johns-Manville Co., H. W. 78
Johnson Service Co. 76

Kewanee Boiler Co. .....Fourth Cover
Knowles Mushroom Ventilator Co., Front Cover

Lavigne Mfg. Co. 86
Lord & Burnham Co. .....Third Cover

Marsh Co., Jas. P. 3
Mason Regulator Co. .....Front Cover
McAlear Mfg. Co. 12
Molby Heater Co. 69
Mueller Mfg. Co., H. 6

Nash Engineering Co. 12
National Air Cell Covering Co. 84
National Regulator Co. 83
National Tube Co. 9

Ohio Blower Co. 87

Paterson & Co., Frank 83
Powers Regulator Co. 84

Ric-Wil Co. 89
Ross Valve Mfg. Co. .....Front Cover

Sarco Company, Inc. 85
Sims Co., The 90
Standard Thermometer Co. 71
Standard Wood Pipe Co. 89
Sturtevant Co., B. F. ....72, 75, 77 and 78

Taylor Instrument Companies 80

United Vacuum Appliance Co. 87

Webster & Co., Warren 70
Westinghouse Electric & Mfg. Co. ... 10
Wyckoff & Son Co., A. 89

TRADE AND MISCELLANEOUS NOTES

Coming Events.

May 21-24, 1917.—Spring meeting of The American Society of Mechanical Engineers, in Cincinnati, O. Headquarters at Hotel Sinton.

June 11-15, 1917.—Twenty-ninth annual convention of the National Association of Master Steam and Hot Water Fitters in Chicago, Ill. Headquarters at the Hotel Sherman.

June 12-15, 1917.—Ninth annual convention of the National District Heating Association, in Detroit, Mich. Headquarters at the Hotel Pontchartrain. Secretary, D. L. Gaskill, Greenville, O.

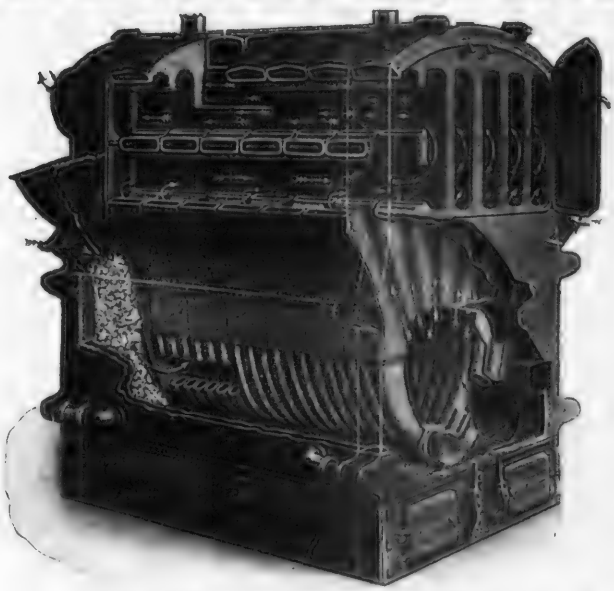
June 19-21, 1917.—Thirty-fifth annual convention of the National Association of Master Plumbers at Evansville, Ind. Headquarters at the new Hotel McCurdy.

July 18-20, 1917.—Summer meeting of The American Society of Heating and Ventilating Engineers, in Chicago, Ill.

Miscellaneous Notes.

Building Operations for March, 1917, showed a slight decrease over those for March, 1916, but the totals, as reported by the *American Contractor,* Chicago, reach the impressive figures of $79,284,262 for 111 principal cities, as compared with $83,624,504 for the same period in 1916. The principal cities reporting increases were: Akron, O., 234%; Cedar Rapids, Ia., 232%; Cincinnati, 29%; Dallas, Texas, 121%; Denver, 40%; Detroit, 34%; Duluth, 777%; Kansas City, Mo., 20%; Milwaukee, 66%. Most of the larger cities, with the exception of Chicago, Cleveland, Cincinnati, and Detroit, reported some decrease. Such cities reporting losses are Boston, 30%; Buffalo, 30%; Minneapolis, 49% New York City, 20%; Philadelphia, 24%; Pittsburgh, 31%. Chicago's figures were practically the same as those for March, 1916, totaling $11,519,650.

DEMANDS SATISFIED



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University of Wisconsin, Madison, Wis., announces that its summer session will open June 25 and will continue until August 3. The courses of study will include chemistry, manual arts, mathematics, chemical engineering, electrical engineering, mechanical drawing and steam and gas engineering. The summer session fee is $15.00.

American Institute of Chemical Engineers will hold its ninth semi-annual meeting in Buffalo, N. Y., June 20-22, 1917.

Eastern Trade Golf Association, an organization made up of men in the heating and plumbing trades, took a patriotic action at its recent annual meeting by voting to devote to the American Red Cross Society all of its prize funds for the season of 1917. Medals commemorating the action will be awarded to the winners in lieu of cups.

National Association of Master Plumbers, whose forthcoming annual convention will be held in Evansville, Ind., June 19-21, 1917, will hold its sessions and will also have its exhibit in the new Coliseum, which has recently been completed especially for convention purposes.

Cleveland, O.—Employers in the building trades in Cleveland whose operations were tied up for a month, first by strikes by union workers and then by lockouts declared by the contractors, have succeeded in winning an important victory for the observance of written arbitration agreements. By the terms of the settlement, disputes between workmen and the employers are first to be submitted to a committee of workmen and employers in the respective trades. Appeal may be made to a conciliation board composed of seven members of the union's council and seven members of the association and there is to be no strike or lockout until this board has had ample time to arrive at a settlement. The agreement also contains provisions that there shall be no limitation as to the amount of work a man shall perform in a day, no restriction in delivery or use of material, except prison-made material; no restriction in the use of apprentices, and gives the employers the right to employ or discharge whoever they see fit. There was formerly an agreement between the employers and workmen in Cleveland

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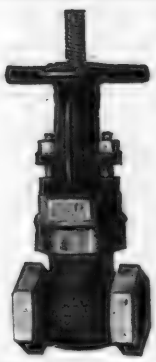
which the Building Trades Council (union) voted to ignore, precipitating the tie-up.

Buffalo, N. Y.—The International Railway Company has entered into a contract with the Peter Smith Co., Cleveland, for the installation of Peter Smith heaters in the street cars of Buffalo. 350 cars will be equipped at a cost of $60,000. The system is similar to that used in Cleveland, Rochester and Detroit. Each car will have a hard-coal-burning stove on the front platform, and air will be drawn in from the outside and passed over heating coils in the stove and then delivered through ducts to the interior of the car.

Detroit, Mich.—Mrs. Laura F. Osborn, candidate for the six-year term on the Detroit school board, is agitating for a change in the ventilation of the older school buildings, constructed since 1910, so that the cloakrooms will not be used as part of the exhaust air shafts of the ventilating system. Mrs. Osborn states that through a report made through the Twentieth Century Club in 1910, the desired change was secured in the design of new school buildings, but that the board refused to make the change in the schools completed. This system, she added, is an actual menace to the health of the children and is destructive of their clothing as well. The foul air of the school room, laden with chalk and floor dust, effluvia from the bodies and clothing of the pupils, and with the germs of contagious diseases, is forced through the children's wraps, which form an effectual filter and retain dust and disease germs to be carried into the home. The immediate occasion of Mrs. Osborn's campaign is the scarlet fever epidemic in Detroit.

Dayton, O.—The Dayton Bureau of Municipal Research, which has recently completed a survey of the public school buildings in Dayton, apropos of the construction of four new school buildings, criticised the practice of advertising only for bids for the furnace blast system of heating for the new Whittier and Cleveland Schools, and states that while the initial cost of a furnace blast system is lower than that of a steam plant, there is no guarantee that the cost of operation will be lower."

Chicago, Ill.—Equipment of Chicago's street cars with a new ventilating and heat control system has begun. The contract for this work has been awarded to the Railway Utility Company and amounts to $500,000. The ventilating system has been devised to meet the health department's requirements that 40,000 cu. ft. of air must pass through a Chicago street car every hour without causing dangerous drafts. The heat control system is planned to keep street cars during the winter months, at a temperature not lower than 50° F. and not higher than 52° F. Both the heat control and ventilating systems have been thoroughly tried out in Chicago for 128 days during the past winter. The ventilat-



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Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

ing apparatus has had to be especially devised as the requirements, it is claimed, demand 50% more fresh air in a street car per hour, than those of any other city in the United States. The apparatus consists of two compensating intakes at the two ends of a car and four honeycomb ventilators on either side. All are at the top of the car. The intakes open automatically to a width of 16 in. when the car has stopped or is moving slowly. They close to a width of 1½-in. when the car is running rapidly. 2,302 cars will be equipped with the ventilating system. The heat control system requires the full complement of 16 electric heaters in each car. Heat is shut off automatically just before it reaches 52° and is turned on when the thermometer falls to near 50°. The management of the Railway Utility Company claims that tests made with the combination ventilation and heat control system show that $25.00 a car per season can be saved in electric heating bills, besides maintaining a comparatively even temperature.

Davenport, Ia.—The proposed steam

Sturtevant

Autoforce Ventilators

They utilize wind pressure to create a powerful suction that draws air out of the building. Thus they are enabled to displace three times as much air as any stationary ventilator of the same size, and twice as much as ventilators of the swinging cowl type.
They swing in the lightest winds—work on the same successful principle as steam injector or Hancock inspirator. Made by the largest manufacturers in the world of fans, fan systems, heating and ventilating apparatus.

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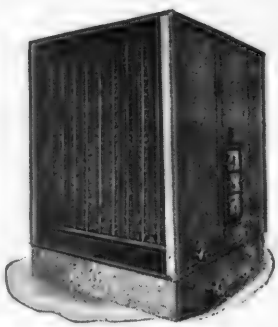
Provide a Dependable Supply of Clean, Pure Air in Public and Industrial Buildings



The unique position of our engineers in originating and bringing air conditioning apparatus to present day efficiency, and in directing many hundreds of successful applications enables us to offer valuable co-operation to architect, engineer and owner.

Our erecting service also makes it possible to guarantee results under unusually difficult conditions. Where desired, we deliver the apparatus in operation and assume complete responsibility.

Tell us your requirements.

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Detroit Packless Valve trimmings are nickeled before being assembled. The plate is extra heavy, and by a special process is made as permanent as the valve itself.

No other valve is so handsomely plated or has such lasting lustre

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DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO.

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

boiler inspection ordinance which is before the city council, was endorsed by the local manufacturers, at a recent meeting of manufacturers and city officials at the Davenport Commercial Club, provided it would not work a hardship upon the manufacturers in the way of heavy additional expense.

Des Moines, Ia.—The State assembly refused to pass the Miles bill prohibiting the installation or maintenance of warm air furnaces in the basements of schools not of fire-proof construction and more than two stories in height. The bill was defeated by a vote of 46 to 40.

Chicago, Ill.—According to the number of stacks against which complaints have been filed with the city smoke inspector, there are about three times more smoke, soot and dirt in Chicago than usual. The number of offending stacks totals 308 this year, as against 425 for all of 1916. The majority of complaints is against apartment buildings. E. W. Pratt, of the Northwestern Railroad, urges owners of apartments and houses to buy their Pocahontas

Showing Ilg Self-Cooled Motor Propeller Fan Exhausting Acid Vapor in a Tannery

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Self-cooled Motor Propeller Fans

Are Ideal for Handling Smoke, Heat, Steam, Dust, Acid Vapors

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QUICK SHIPMENTS

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158 Whiting St., Chicago

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Large Strainer Area in

Sturtevant
(REG. U.S. PAT. OFF.)

AirWasher

In Sturtevant Air Washer there is a strainer area more than twice as great as in any other washer and ten times the area of some.

The mesh frames can be readily removed for cleaning.

Other advantages of the Sturtevant Air Washer are:

More nozzles per thousand cubic feet of air than any other washer.

Trap in overflow.

Supplies more water to eliminator plates for auxiliary washing than any other apparatus.

Furnished with louver diffuser on inlet side.

Catalog 226-V sent on request.

B. F. STURTEVANT COMPANY
HYDE PARK BOSTON, MASSACHUSETTS

And all Principal Cities of the World.

Stationary Vacuum Cleaners Engines Fans Heaters Motors

coal now, as otherwise the conditions next winter will be as bad as before. Alderman Nance, chairman of the health committee of the city council, states that "it appears that soft coal can be used without smoke if an arch is placed in the firebox. I believe that owners of apartments should be required either to adapt their furnaces to the use of soft coal or be required to purchase hard coal or Pocahontas."

Salt Lake City, Utah.—James H. Wallis, of the State Board of Health, in a recent address before a convention of janitors employed in the public schools of Davis County, stated that poor janitor service in school houses and grounds had cut down the scores in the "clean town" contest, of which Mr. Wallis has been adjudicator for the past three years.

W. F. Schaphorst, M. E., New York, advertising engineer and a contributor to the technical journals, has established an engineering advertising service, with offices in the Woolworth Building. He solicits business with manufacturers of high-grade engineering products.

Salt Lake City, Utah.—A survey of the public school buildings of Salt Lake City, with special reference to the heating and ventilating systems, is being made by the buildings and grounds department of the Board of Education. The plants in 17 buildings have been examined and tested. Twelve more remained to be surveyed. The work involves measuring the fresh air delivered to each classroom, its humidity, and the checking up of all radiation and boiler plants to see if the heating plants are adequate and properly designed to permit economical operation. The ventilating systems of some of the newer school buildings, including several of the newer schools, were shown to be far below standard.

Columbus Heating and Ventilating Co., Columbus, O., had a flag-raising at its plant, April 12, when Mayor Karb made an address and the Old Guard Drum Corps rendered martial music.

Manufacturers' Notes.

Positive Differential System Co., New York, announces the removal of its offices to 9 Murray St. Larger quarters have been secured at the new address for carrying the company's line of impulse and differential valves, fractional valves and "Thermo-float" air valves. New catalogues are in preparation on the company's positive air return system and vacuum return line system.

Metal Sylphon Diaphragm Valves

ORIGINATED WITH THE

Johnson System of Temperature Regulation

The Pioneer System and Leader in Improvements

Untested imitations and substitutes followed fast, but, having been thoroughly tested and proved equal to the demands,

The SYLPHON is the Recognized Standard

It costs no more to install the JOHNSON SYSTEM than inferior products, so why assume the risks?

Communicate with our nearest branch in regard to your temperature regulation requirements.

Our co-operation is yours for the asking.

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The indestructible sylphon metal diaphragm valve

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Heating and Ventilating Contractors: Federal Heating Co., Washington, D. C.

Apartments That Rent for $15,000 a Year

The McCormick Apartment House in Washington is essentially highclass and luxurious in every single detail. The house has only one apartment on each floor with the exception of the ground floor where there are two apartments. There are about 26 rooms to a floor.

In this most palatial building it is not surprising that Sturtevant apparatus should be chosen to exhaust the air from the kitchens.

The name Sturtevant is always associated with quality.

Catalog No. 230-V on Sturtevant Heaters is our latest publication of interest to Engineers. Send for your copy.

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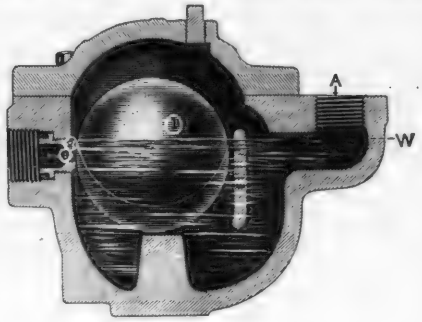
Johns-Manville Steam Trap

Just Three Parts - Only one Moves



1. The Rolling Ball
2. The Discharge Bushing
3. The Body

It would be impossible to make an efficient steam trap with fewer parts than are used in the Johns-Manville Trap. Only three parts—the rolling ball, the discharge bushing and the body—and the ball is the only part that moves.

When water first flows into the trap at A and begins flowing out of the discharge orifice B, the ball (1) floats to and is held against the discharge bushing (2) by an unbalanced steam pressure.

The discharge orifice is thus completely sealed until the water level reaches W, at which point the buoyant force of the water begins rolling the ball upwards on the face of bushing (2) thus exposing a part of or all of the discharge orifice B, depending upon the quantity of water entering the trap.

When the quantity of entering water decreases, the water level drops and the ball again drops until it partially or completely covers the discharge orifice B and is held tightly against the face of the bushing (2) by the unbalanced steam pressure. Hence a water seal is always provided between the steam in the trap and the discharge orifice B, eliminating all possibility of steam leakage.

Thus the Johns-Manville Trap discharges continually, as long as water flows to it.

The Johns-Manville Trap will not air bind. Air, lighter than water and heavier than steam, is discharged through small vortices that are formed near the discharge orifice.

Ask for the special Johns-Manville Steam Trap Bulletin.

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

H. W. Johns-Manville Co.
New York City
10 Factories—
Branches in 55 Large Cities

Braemer Air Conditioning Corporation, Philadelphia, Pa., has published a circular announcing its organization, as reported in THE HEATING AND VENTILATING MAGAZINE for March. Most of the district managers, who cover the cities of Cincinnati, St. Louis, Kansas City, Indianapolis and Cleveland, have for many years represented the air conditioning department of Warren Webster & Co. The circular contains photographs of the officers, including William G. R. Braemer, president; Herbert Coward, treasurer; and H. A. Terrell, secretary. A New York office has been opened at 90 West Street, with G. P. Uppington as district manager. Mr. Uppington is a graduate engineer, with eleven years' practical experience in heating, ventilating, air conditioning and sales work.

H. W, Johns-Manville Co., New York, announces that J. D. Vail, formerly manager of the company's Salt Lake City branch, has been appointed manager of the building materials department of the company's branch in Chicago. In future the Salt Lake City office will be in charge of C. F. Cate. The Great Falls, Montana, office will be managed independently by J. H. Roe.

Carrier Air Conditioning Co., Buffalo, N. Y., reports an order for one of its generator coolers from Compagnies Re-

Use Separate Heating Units

Why install one large unit for heating rooms which are used probably 20 hours a day and also rooms which are used only a few hours a day or a few times a week. Investigate the

Sturtevant

Electric Heat Blower

Send for Bulletin 219-V

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nd all Principal Cities of the World

THE necessity for proper ventilation for night workers is even more eminent than for day workers—because the night shift works under unnatural conditions—

Efficiency Engineers have proclaimed ventilation as a most important factor in getting maximum production at any time—therefore it becomes doubly important where overtime or night work is required.

By actual test Sirocco Ventilating Equipment has been instrumental in increasing production in many types of industrial building.

Efficiency demands many provisions, one of which is good air—that's Sirocco's reason for existence—to condition air according to requirements.

Stability—

with reference to Sirocco Design and Construction?—also stability in providing a medium which enhances the health of work people—their productive capacities—their attendance record, all of which means profits to your company.

Service

That means after as well as before the installation of Sirocco Equipment.

Before—In applying that size and arrangement of "Sirocco" best suited to your requirements.

After—In seeing to it that our recommendations are suppelmented by actual results.

Double "Sirocco" wheel for confined installation spaces.

Bulletin No. 2704 tells about "Sirocco" installations.

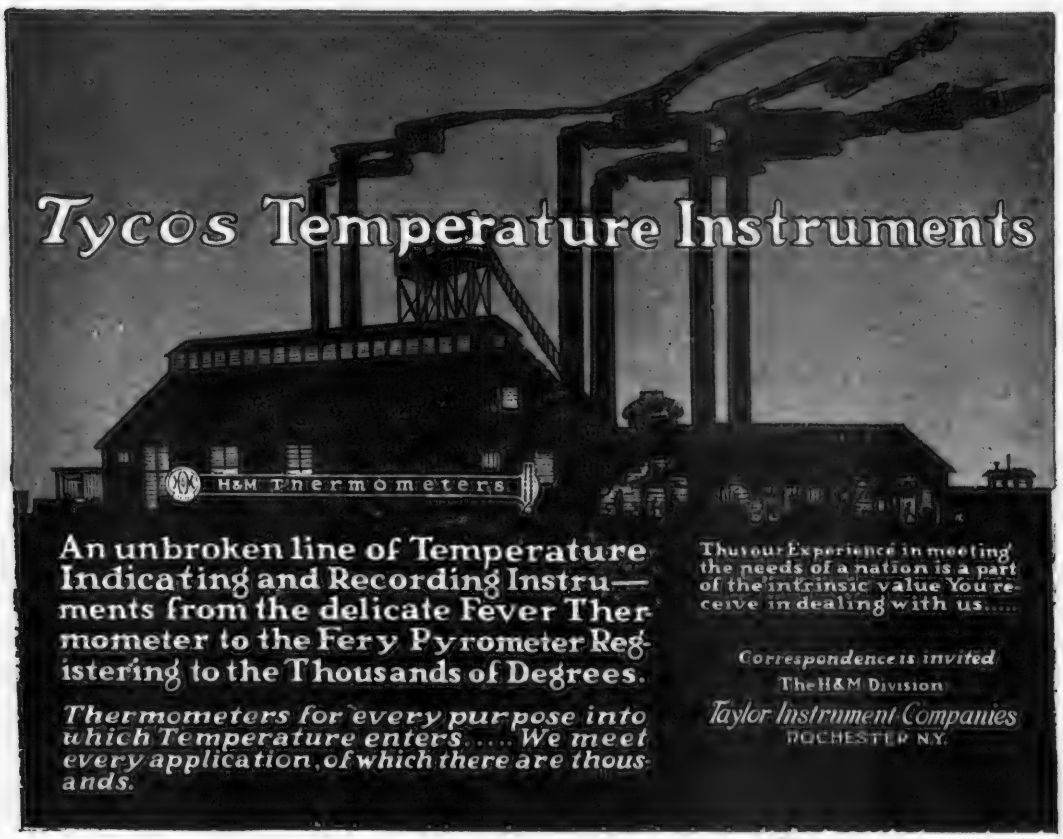
AMERICAN BLOWER COMPANY
DETROIT, MICH.

unies Gaz & Electricite, of Lisbon, Portugal. The equipment is to be complete, with motor-driven spray pump and patented Cyclone nozzles of the non-clogging type. The turbo-generator, whose air supply is to be washed and cooled, is 9,400 K.V.A. rating. Following the practice in the United States, dry filters are being discarded for wet washers.

Hart & Crouse Co., Utica, N. Y., announces that its general sales offices have been moved from the factory office in Utica to the company's own building, at 1,220 New York Avenue, N. W., Washington, D. C. E. L. Stock, has been elected director, vice-president and general sales manager of the company and will be in charge of the Washington headquarters. A. J. Lowndes, formerly manager of the company's Baltimore office, has been transferred to Chicago where he will be manager; Lilburn H. Steel, formerly connected with the Washington office, has been made manager of the Baltimore office; Albert M. Schneider, formerly connected with the National Radiator Company, has been appointed manager of the Cleveland office of the Hart & Crouse Co.; W. W. Towson, Jr., formerly manager of the company's Atlanta office has been transferred to Washington to assume the position of assistant general sales manager. Other changes are: John C. Candler, formerly connected with the Atlanta office, appointed manager of that branch; L. B. Sherry, who formerly covered the central section of New York State, has been transferred to the Washington office to cover the Virginia territory; S. M. Jones, formerly located at Utica, has been transferred to Washington as assistant to the vice-president; A. L. Jacoby, formerly connected with the Virginia-Carolina Supply Co., Norfolk, Va., is now located at Charlotte, N. C., to cover North and South Carolina and eastern Tennessee; and E. C. Stephen, formerly covering the eastern section of New York State, has been transferred to the Washington office to become manager of the company's furnace department.

Wm. B. Scaife & Sons Co., Pittsburgh, Pa., manufacturers of steel tanks, has completed extensive additions to its plant in Oakmont, the additional buildings covering 14 acres. The company's main office was recently moved to the First National Bank Building, Pittsburgh.

United States Radiator Corporation, Detroit, Mich., has appointed Rudolph L. L. Kern as traffic manager, with headquarters in Detroit. Mr. Kern succeeds J. J. O'Donnell.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Thermometers for every purpose into which Temperature enters..... We meet every application of which there are thousands.
Thus our Experience in meeting the needs of a nation is a part of the intrinsic value You receive in dealing with us.....
Correspondence is invited
The H&M Division
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ROCHESTER N.Y.

Kellog-Mackay Co., Chicago, Ill., is building a two-story brick and reinforced concrete warehouse at Ninth Avenue in Minneapolis, Minn., at Ninth Avenue and Fourth Street, where the company will carry a complete line of boilers, radiators and heating and plumbing supplies for this supplying the trade throughout the Northwest.

Scientific Heater Co., Cincinnati, O., has increased its capital from $50,000 to $100,000.

New Incorporations.

Ernst Plumbing & Heating Co., Quincy, Mass., capital $10,000. Incorporators: Walter Ernst, Charles Hildebrand and George W. Ernst.

Vapor Car Heating Co., New York, capital $3,500,000, to take over the Standard Heat and Ventilation Company and the Chicago Car Heating Co. Egbert H. Gold, president of the Chicago Car Heating Co., will be at the head of the new organization.

Campbell-Eisenhauer Co., Tuckahoe, N. Y., capital $20,000, to deal in heating and plumbing supplies. Capital $20,000. Incorporators: T. and V. Eisenhauer and R. J. Campbell, of Tuckahoe.

L. & K. Heating Co., Toledo, O., capital $1,000. Incorporators: Jessie F. Ehring, Don Wagner, William Spence, Fred. F. Stullon and Horace S. Kerr.

Humirad Co., Inc., New York, capital $15,000, to manufacture air humidifying and other air conditioning systems, and ventilating appliances. Incorporators: R. W. Hardie, A. T. Palmer and S. R. Bell, Larchmont.

Bradley Development Co., Inc., New York, capital $10,000, to conduct a business as contractors of heating and power plants. Incorporators: J. L. Bertie, R. D. Rodamond, and B. O. Berry, Woolworth Building.

Wanted.

Position Wanted. — Thoroughly-experienced heating and ventilating engineer desires position in or near New York City. A-1 designer, estimator, salesman and superintendent. Reliable, practical, successful. Reasonable salary. Address X.Y.Z. care of Heating and Ventilating Magazine.

Wanted.—Experienced estimator and designer of heating and ventilating systems wanted by New York contractor. Give salary wanted and references. Address M. P., care of Heating and Ventilating Magazine.

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Are you planning to give your clients a natural air condition during the heating season?

Not psychological but real humidity may be had under all conditions by using

STEAMO and VAPO AIR MOISTENERS

Tests have shown that the cost of the best evaporating device is 11 times greater for the same quantity of moisture than that of the Steamo Air Moistener.

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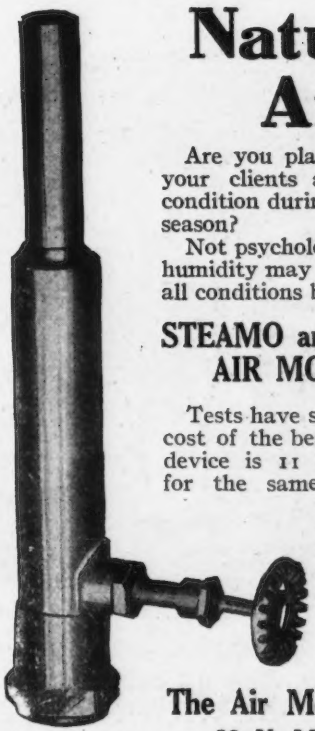

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For measurement of boiler-feed supply, make-up water or condensation we call attention to the principle of operation of this meter, which measures by actual volume displacement, and is therefore accurate, irrespective of rate of flow or water temperature.

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With the meter, we offer recording equipment, either counter or graphic chart device, as may appeal to customers as most convenient for their requirements.

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PLEXIFORM FAN

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Plexiform wheel construction is as aptable for double width as for single width fans, and is the only type of multiple blade wheel fan that is equally adaptable for high or low pressures without change in design and construction.

We have Fans of standard Plexiform construction handling air at —50 deg. and gases at 1,000 deg. temperature.

Write for catalogs.

BAYLEY MANUFACTURING CO., Milwaukee, Wis.

The Heating and Ventilating Magazine

VOL. XIV. NO. 6

Contents for June, 1917

Experimental Plant of the New York State Commission on Ventilation in School No. 51, New York City 15

Quantitative Determination of Air Dust, ... *E. Vernon Hill, M.D.* 23
A Review of the Difficulties Encountered and the Development of a New Type of Dust Counter.

Comparison of Pipe Coils and Cast-Iron Sections for Warming Air, *Professor John R. Allen* 33
Tests Demonstrating that Condensation for Both Types of Surface Depends Upon Friction Through the Heater.

Explosions in Enameling Ovens 40

How To Build Houses to Retain Heat 41

Air Cooling and Refrigeration 43
Elements of Refrigeration.

Power Plant Engineering 46
The Design of a Building Power Plant.

Correspondence 49
Fuel Economy and Humidification.

Current Heating and Ventilating Literature 49

The Weather for April, 1917 50
New York, Boston, Pittsburgh, Chicago and St. Louis.

American Society of Heating and Ventilating Engineers 52
Summer Meeting to Take Up War Problems.
New Year Book.
New York Chapter Discusses Military Matters.
Annual Banquet of Michigan Chapter.
Illinois Chapter Holds Dinner Dance.
Automatic Heat Control Discussed by Eastern Pennsylvania Chapter.

National Association of Master Steam and Hot Water Fitters 53
Master Steam Fitters' Convention Postponed.
New York State Association.

National Pipe and Supplies Association 54

National District Heating Association 54
Committee Named to Co-Operate with Governmment.

Building Operations for April 54

Standard Heating and Ventilating Data Sheets 55
No. 8a—Air Changes—Hospitals.
No. 8b—Air Changes—Hotels and Libraries.
No. 8c—Air Changes—Schools.
No. 8d—Air Changes—Miscellaneous Buildings.

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The DUNHAM VAPOR HEATING SYSTEM

THE DUNHAM TRAP does away with all pounding in pipes. Half hot—half cold radiators an impossibility. No hissing, sputtering valves.

THE DUNHAM INLET VALVE installed at top of radiator does away with stooping and all wrist-tiring turning. A single turn and heat is on or off. Many other special Dunham features. Investigate before planning or installing your next residence contract. Write for details.

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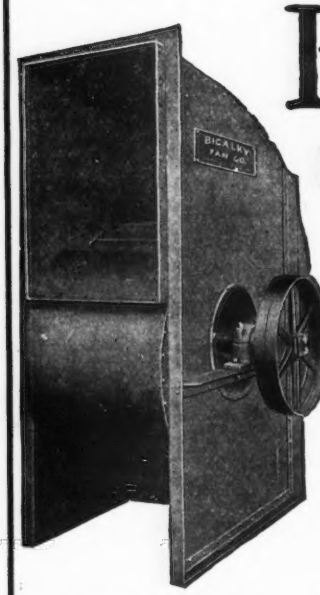

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The efficiency obtained with these fans has upset all previous engineering dope.

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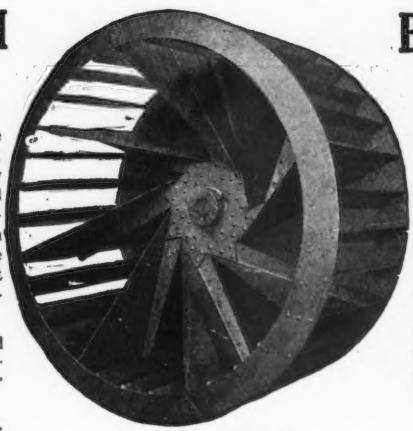

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This, in connection with their high efficiency, has created the large demand for

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